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# Hamilton Rapid Transit Preliminary Design and Feasibility Study

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## A-LINE

### NATURAL ENVIRONMENT INVENTORY & IMPACT IDENTIFICATION

Version:2.0



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February 2012

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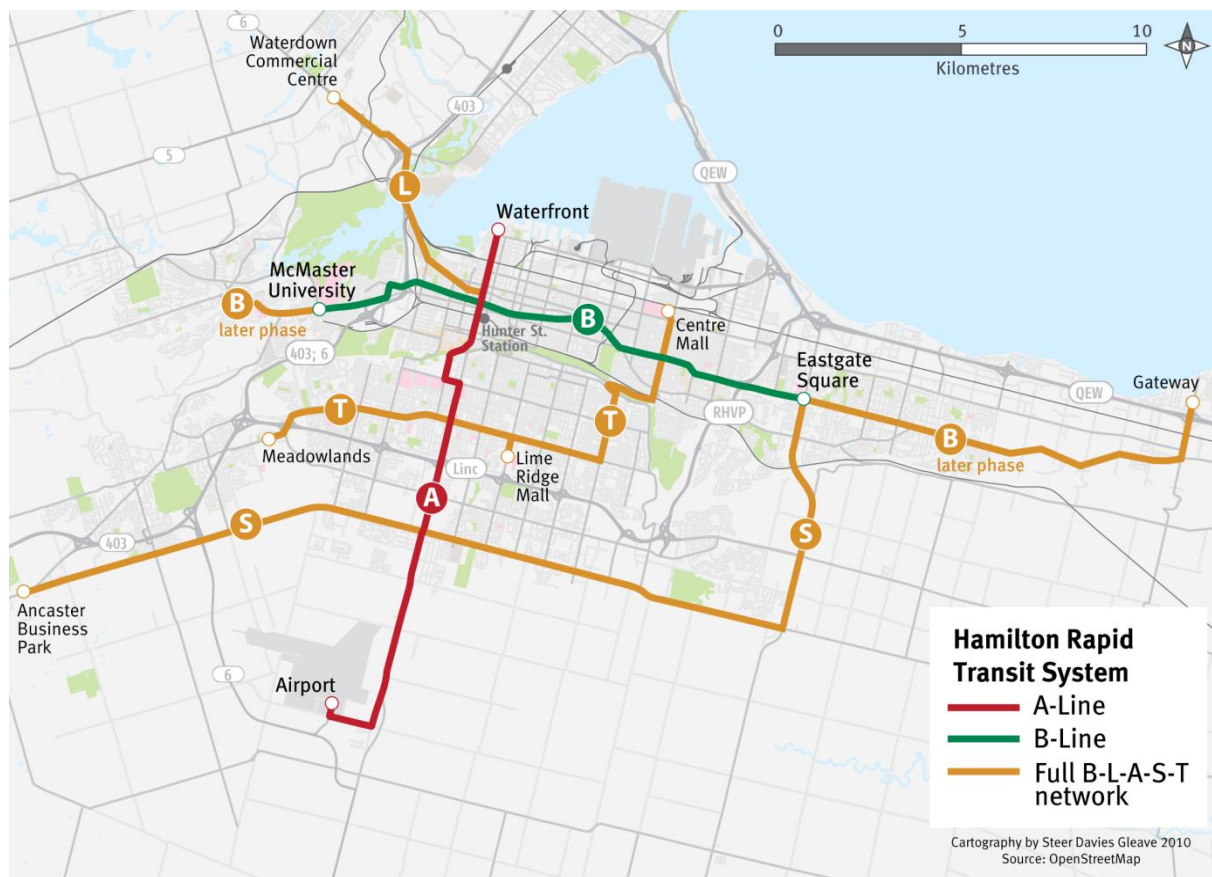
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## 1.0 INTRODUCTION

### 1.1 Background and Context

The City of Hamilton has a plan to implement a rapid transit network (referred to as B-L-A-S-T) which, in the long term, will encompass five corridors. The City is currently focused on Light Rail Transit (LRT) for its primary east/west corridor, along King Street and Main Street, between Eastgate Square and McMaster University (the B-Line), with the intent of having it ready by 2015. It is also in the process of defining a potential corridor and mode of rapid transit for the City's primary north/south corridor, along James Street and Upper James Street, between the Waterfront and the Hamilton International Airport (the A-Line), as shown in Figure 1.1.

**Figure 1.1: General Location of the A-Line and B-Line within the B-L-A-S-T Network**



The current work for the A-Line includes development of corridor alternatives, identification of potential hubs and land use strategies, development of a phasing strategy and public consultation. Supplementary activities associated with the current work include establishing an inventory of natural heritage features and a natural heritage features impact review, based on the mode of choice. These supplementary activities are documented in this report. The natural heritage components addressed include:

- Aquatic Ecosystems and Fisheries
- Terrestrial Ecosystems
- Hydrogeology and Contamination

## **1.2 Description of A-Line Corridor Options**

The A-line Technology Opportunities Report has identified preferred Light Rail Transit (LRT) and Bus Rapid Transit (BRT) options for the A-Line (Figure 1.2) and these are the two options assessed in this study. Over the majority of the route, these follow a common alignment with common stop locations, which enables a direct comparison of the different technologies. However, due to the differing gradient climbing capabilities of buses and light rail vehicles (LRVs), different alignments have been adopted for these two technologies from Downtown (King Street) over the Niagara Escarpment.

More detailed concepts for the BRT and LRT routes are shown on an aerial photo base in Appendix A.

The recommended BRT route commences at the Waterfront stop, located to the north of Guise Street East, and runs along James Street North to the Downtown area, crossing the B-Line at King Street. The route continues along James Street South, James Mountain Road, West Fifth Street and Fennel Avenue to then follow the Upper James Street and Homestead Drive route into the Airport.

The route is generally within the existing street from James Street North/Guise Street to south of Rymal Road. From here to the intersection of Upper James Street and Homestead Drive, the route runs on a segregated alignment, on the west side of Upper James Street, then continues on-street along Homestead Drive and Airport Road, with a terminal loop following the existing circulatory road at the Airport. This route serves all the key locations along the James/Upper James corridor.

Proposed stops on this route are:

- Waterfront
- Picton
- James Street North GO Station (proposed)
- Cannon Street
- Gore Park
- Hunter Street GO Centre
- St Joseph's Hospital
- St Joseph's Mountain Campus
- Mohawk College
- James & Fennell(for Mountain Plaza)
- James & Mohawk
- Aldridge/Linc
- Stone Church
- Rymal
- Twenty Road
- Mountain Transit Centre
- Dickenson
- English Church
- Mount Hope
- Warplane Museum
- Hamilton International Airport

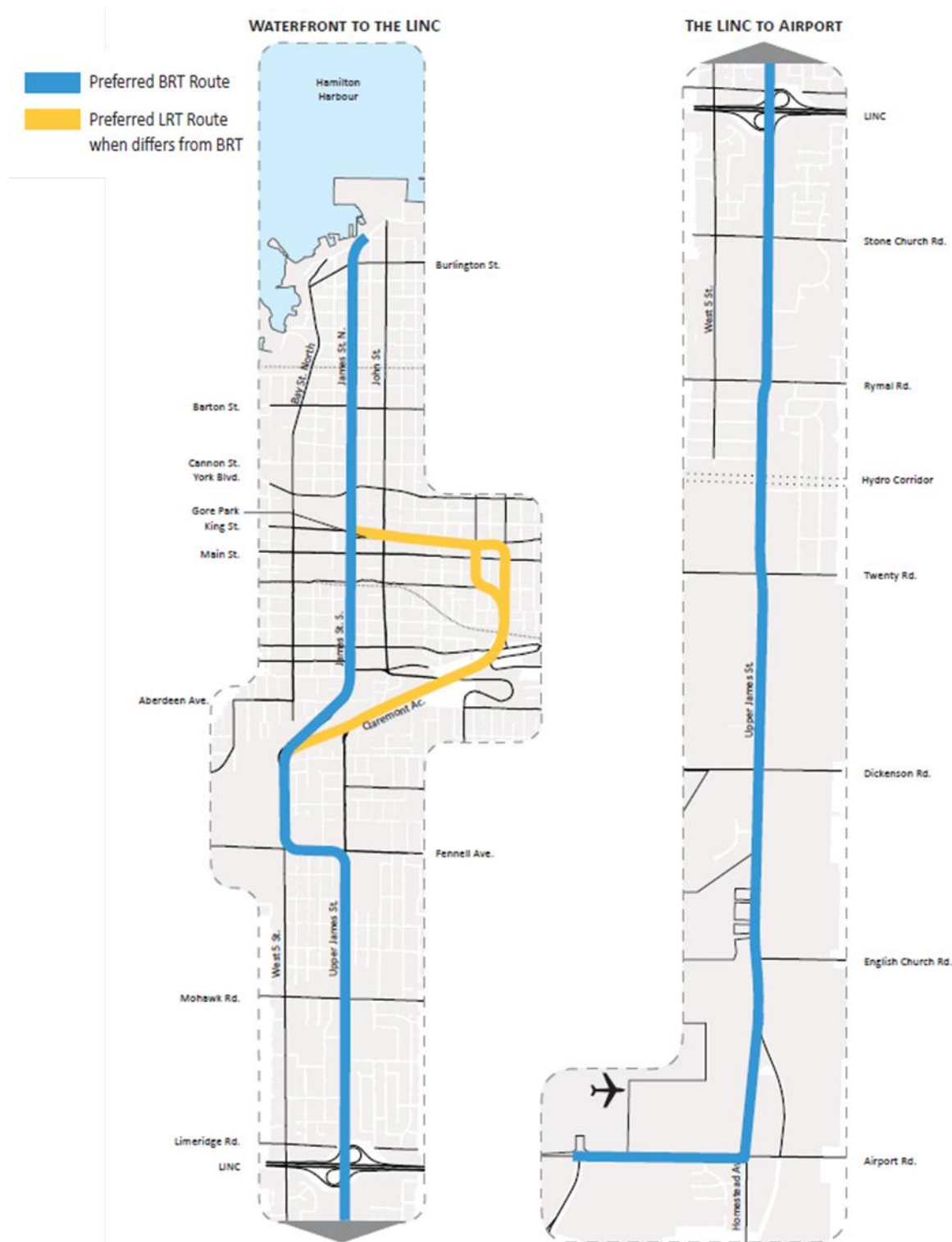
LRVs cannot operate on the almost 11% gradient on James Mountain Road, and so the recommended LRT route uses the 6% gradient Claremont Access. The route follows the same alignment as the BRT option from the Waterfront terminus (but the terminal loop is not required) on James Street North, then runs along the B-Line tracks to Wellington Street/Victoria Avenue. A-Line services would run through the B-Line stops at Walnut (both directions) and First Place (westbound only). An additional stop on the B-Line is provided at Gore Park to allow for passenger transfer between bus services at the MacNab terminal, B-Line services west of the Downtown area and the A-Line.

The LRT route then ascends the Escarpment via the Claremont Access and the ramp to West Fifth Street. From Fennel Avenue to the airport, the route is the same as for the BRT option, except that the terminal loop is not required.

Proposed stops on this route are:

- Waterfront
- Picton
- James Street North GO Station (proposed)
- Cannon Street
- Gore Park (common with B-Line)
- Walnut (common with B-Line)
- First Place (w/b common with B-Line)
- St Joseph's Mountain Campus
- Mohawk College
- James & Fennell(for Mountain Plaza)
- James & Mohawk
- Aldridge/Linc
- Stone Church
- Rymal
- Twenty Road
- Mountain Transit Centre
- Dickenson
- English Church
- Mount Hope
- Warplane Museum
- Hamilton International Airport

Figure 1.2: A-Line LRT and BRT Option Alignments



## **2.0 AQUATIC ECOSYSTEMS AND FISHERIES**

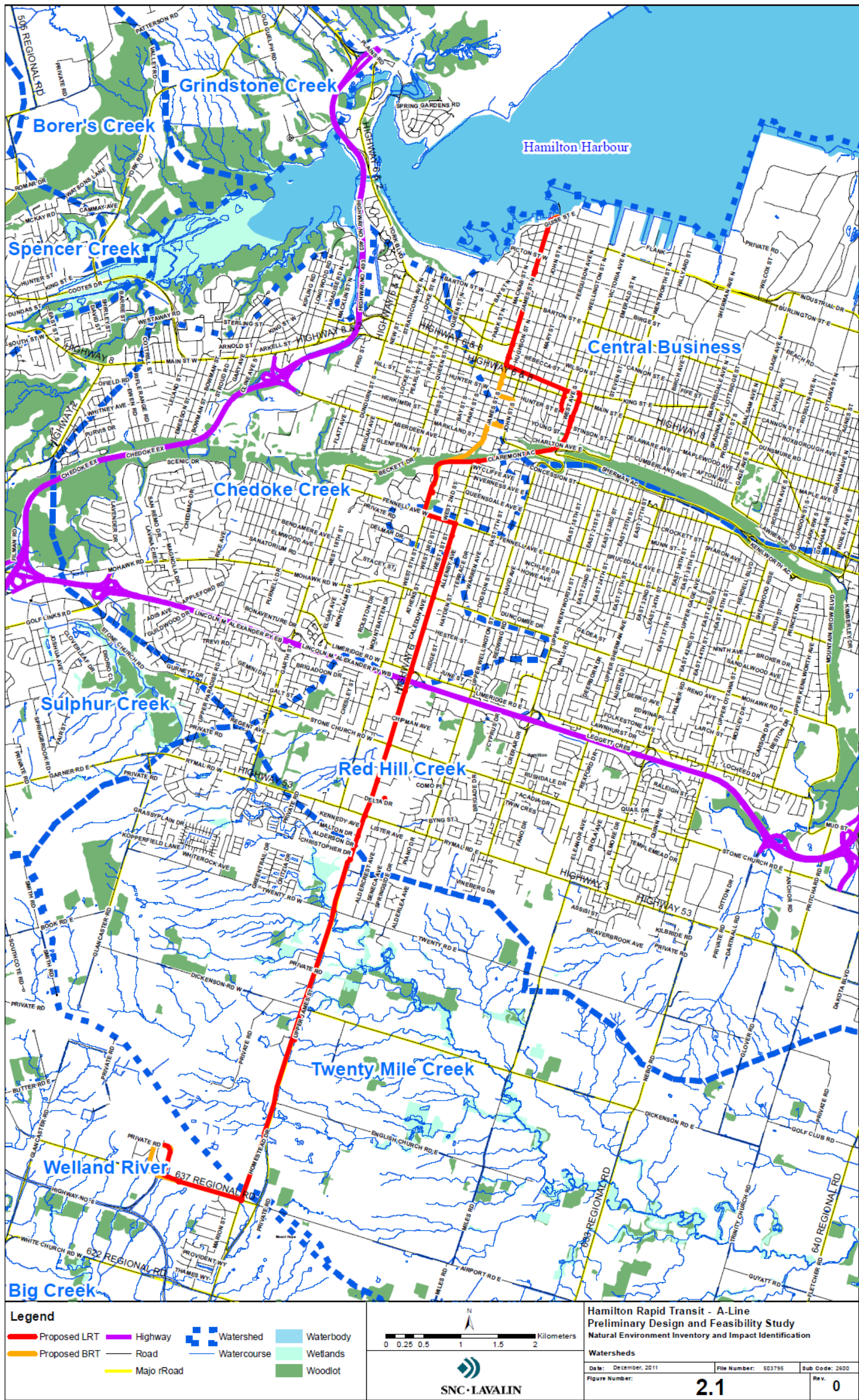
### **2.1 Introduction**

The purpose of this section is to document the existing aquatic habitat conditions of all the watercourses within the study area for the A-Line corridor. The proposed A-Line corridor crosses four watersheds, specifically Spencer Creek, Red Hill Creek, Twenty Mile Creek and the Upper Welland River watershed (refer to Figure 2.1). The northern extent of the corridor, below the Niagara Escarpment, travels through a part of the City of Hamilton which is heavily urbanized. In this area, the historic watercourses/drainage features are no longer present and have been piped underground as part of the storm sewer system that discharges to Lake Ontario (Hamilton Harbour).

All of the watercourses within the study area have reaches that have been altered through a combination of agricultural and urban development, and are generally considered to have degraded habitat conditions for aquatic life.



Figure 2.1: A-Line Study Area Watersheds





## 2.2 Methodology

The description of the existing aquatic conditions involved the collection and review of secondary source information and collection of data during the field investigations by SLI in November, 2010. The background sources reviewed and the field approach utilized for the project are summarized below.

### 2.2.1 Background Data Collection

Background data were collected and reviewed from various published and non-published sources. Sources of information include:

- Mewburn and Sheldon Neighbourhoods Master Servicing Plan. Class Environmental Assessment (Class EA) Study. SNC-Lavalin Inc., 2004.
- City of Hamilton Airport Employment Growth District - Phase 2. Draft Subwatershed Study and Draft Stormwater Master Plan. Dillon Consulting. April 2010.
- Fisheries Management Guidelines – Niagara Area, Ministry of Natural Resources. February 2000.
- Ontario Ministry of Natural Resources (MNR), Guelph District.
- Hamilton Conservation Authority (HCA).
- Niagara Peninsula Conservation Authority (NPCA).
- Class EA Ecological Assessment Requirements for Baseline Conditions, S. Faulkenham, HCA, March 26, 2009.
- Natural Heritage Information Center (NHIC) website 2010.
- City of Hamilton, Strategic Planning & Rapid Transit, Environment and Sustainable Infrastructure Division
- Urban Hamilton Official Plan, Schedule B, Natural Heritage System, July 2009.
- COSEWIC. 2009. Canadian Wildlife Species at Risk. Committee on the Status of Endangered Wildlife in Canada. Web site: [http://www.cosewic.gc.ca/eng/sct0/rpt/rpt\\_csar\\_e.cfm](http://www.cosewic.gc.ca/eng/sct0/rpt/rpt_csar_e.cfm) [accessed 25 Sept 2010].
- Species at Risk in Ontario (SARO) List. Updated September 29, 2010.

### 2.2.2 Field Surveys

To confirm background conditions and the sensitivity of fish and fish habitat reported by others, a field investigation was conducted on November 12, 2010 and November 8, 2011 to fully characterize and assess habitat features present at the watercourse crossings in the study area for the A-Line corridor. Field data collection methods included:

- **Documented information** on stream type, substrate, morphology, bank stability, in-stream cover, near shore cover vegetation, migratory obstructions and presence of any critical habitat (i.e., spawning);
- **Photographic Documentation** of existing fish habitat conditions for the watercourses within the study area.

The field investigation study area for the watercourse crossings included the proposed A-Line corridor, plus 50 metres upstream and 200 metres downstream of the assumed right-of-way (ROW) of the corridor.

Fish community sampling and inventory was not completed, as background data were deemed sufficient for the assessment of the fish community present at the watercourses in the study area. Information reported on fish species is primarily from MNR historical fish collection records available and the Fisheries Management Guidelines – Niagara Area (MNR, 2000). The timing of the field investigations in November,

2010 (fall) was considered appropriate to confirm and assess existing physical (e.g., flow regime, temperature) and biotic (e.g., aquatic vegetation) habitat conditions, and specific fish use of interest.

The fish habitat assessment was conducted utilizing the general methods and procedures outlined in the MNR Ontario Stream Assessment Protocol (2005). Information recorded included:

- Watercourse size, flow (permanent/intermittent) and thermal regime (coldwater/warmwater);
- Physical channel dimensions and habitat characteristics – width, depth (including bankfull and wetted widths and depths), substrate type, in-stream/overhead cover opportunities (e.g., woody debris, undercut banks, vegetation), bank stability/erosion, channel morphology, groundwater seepage/upwelling areas and riparian vegetation.
- Physical barriers to fish movement in the vicinity of the crossings;
- Identification of potential critical or specialized habitat areas or features (i.e., potential spawning or nursery areas); and,
- Observations of habitat alterations/land use (i.e., channel modification, potential pollutant sources).

Table 2.1 provides a summary of the physical conditions and habitat of the watercourses within the A-Line corridor.

Table 2.1: Watercourses Located in the A-Line Corridor

Watercourse	Flow Intermittent (I) / Permanent (P)	Channel Width and Depth	Substrate Type	Riparian Vegetation	Directly Supports a Fishery (Y/N)	Type of Fishery Supported	Sensitivity (H - High, M - Moderate, L - Low) (provided by NPCA)
Upper Welland River Tributary A (UWR-A)	I	0.2 metres wide and 0.05 metres deep	Small gravel, sand and silt.	Cattail, goldenrod, teasel, burdock	N*	Warmwater	L
Twenty Mile Creek Tributary A (TMC-A)	P	0.3 metres wide and 0.05 metres deep	Gravel, sand and silt.	Willow, coltsfoot, burdock, teasel, milkweed, goldenrod, Queen Anne's lace, Manitoba maple.	Y	Warmwater	M
Twenty Mile Creek Tributary B (TMC-B)	P	0.3 metres wide and 0.15 metres deep	Cobble, gravel, sand and silt.	Willow, Manitoba maple, coltsfoot, goldenrod, burdock, reed canary grass, milkweed.	Y	Warmwater	M
Twenty Mile Creek Tributary C (TMC-C)	I	No defined channel – conveys roadside drainage – cattail choked.	Sand and silt.	Cattails.	N*	Cool/Coldwater (downstream reaches of the tributary are more typical of cool/coldwater systems with a defined channel)	L
Twenty Mile Creek Tributary D (TMC-D)	I	No defined channel – conveys roadside drainage – cattail choked.	Sand and silt.	Cattails, goldenrod, willow, dogwood, reed canary grass.	N*	Warmwater on west side of Upper James and Cool/coldwater on east side of Upper James.	L
Twenty Mile Creek Tributary E (TMC-E)	P	No defined channel – conveys roadside drainage – cattail choked.	Sand and silt.	Cattails, goldenrod, willow, dogwood, reed canary grass, phragmites.	Y*	Warmwater	M

Watercourse	Flow Intermittent (I) / Permanent (P)	Channel Width and Depth	Substrate Type	Riparian Vegetation	Directly Supports a Fishery (Y/N)	Type of Fishery Supported	Sensitivity (H - High, M - Moderate, L - Low) (provided by NPCA)
Twenty Mile Creek Tributary F (TMC-F)	P	No defined channel – conveys roadside drainage – cattail choked.	Sand and silt.	Cattails, goldenrod, willow, dogwood, reed canary grass.	Y*	Cool/coldwater	M
Twenty Mile Creek Tributary G (TMC-G)	I	No defined channel – conveys roadside drainage to downstream habitats.	Sand and silt.	Willow, goldenrod, reed canary grass, asters, nightshade, dogwood.	N*	Warmwater	L
Twenty Mile Creek Tributary H (TMC-H)	P	2.0 metres wide and 0.2 metres deep	Gravel and sand.	Weeping willow, phragmites, cattails, goldenrod, reed canary grass.	Y*	Warmwater	M
Twenty Mile Creek Tributary I (TMC-I)	P	3 metres wide and 0.3 metres deep	Gravel, sand and silt.	Weeping willow, phragmites, cattails, goldenrod, teasel, milkweed, Queen Anne's lace, asters, reed canary grass.	Y*	Cool/coldwater	H
Twenty Mile Creek Tributary J (TMC-J)	P	0.2 metres wide and 0.02 metres deep	Sand, silt and mud.	Cattails, goldenrod, milkweed, asters, reed canary grass.	Y*	Cool/coldwater	M

Note \* - Designated as supporting aquatic species at risk on DFO Distribution of Aquatic Species at Risk mapping, 2010.

### 2.2.3 Aquatic Species at Risk

The designation of aquatic species of national significance is determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), which may then qualify for legal protection and recovery under the federal *Species at Risk Act* (SARA). Endangered, Threatened or Extirpated species on Schedule 1 of the SARA are afforded protection under the Act. The designation of species of provincial significance is based on recommendations made by the Committee on the Status of Species at Risk in Ontario (COSSARO). Species classified as "at risk" (i.e., Extirpated, Endangered, Threatened or Special Concern) by COSSARO are placed on the Species at Risk List in Ontario (SARO List) and are afforded protection under the Ontario *Endangered Species Act* (ESA), with the exception of species of "special concern".

From the review of background information sources, there are three (3) aquatic species at risk within the Twenty Mile Creek watershed and four (4) aquatic species at risk within the Upper Welland River watershed. Table 2.2 outlines the species at risk, and the Niagara Peninsula Conservation Authority (Lee-Ann Hamilton; NPCA Biologist, pers. comm.) has confirmed the aquatic species listed are considered present within the Twenty Mile Creek watershed. Grass pickerel was sampled at Woodburn Road, which is approximately 10-12 kilometres downstream of the study corridor. The fish community sampling did not include a sampling station near Upper James Street due to the shallow water depths.<sup>1</sup> It is unlikely that the aquatic species at risk listed in Table 2.2 are located within the study corridor, due to the fact that the watercourses are headwater tributaries with a lack of suitable habitat (i.e., no in-stream cover or pools) and overall shallow water depths.

**Table 2.2: Aquatic Species at Risk in the A-Line Corridor**

Common Name	Scientific Name	COSEWIC	SARA	COSSARO	ESA
American Eel <sup>2</sup> **	<i>Anguilla rostrata</i>	Special Concern	No status	Endangered	Afforded Protection
Atlantic salmon <sup>1</sup> *	<i>Salmo salar</i>	Extinct	No status	Not on SARO List	Not Applicable
Lake Sturgeon <sup>3</sup> *	<i>Acipenser fulvescens</i>	Threatened	No status	Threatened	Afforded Protection
Grass pickerel <sup>1</sup> **	<i>Esox americanus</i>	Special Concern	Special Concern (Schedule 3)	Special Concern	Not Afforded Protection
Northern brook lamprey <sup>1</sup> **	<i>Ichthyomyzon fossor</i>	Special Concern	Special Concern (Schedule 3)	Not on SARO List	Not Applicable
River redhorse <sup>1</sup> **	<i>Moxostoma carinatum</i>	Special Concern	Special Concern (Schedule 3)	Not on SARO List	Not Applicable
Redside dace <sup>3</sup> *	<i>Clinostomus elongatus</i>	Endangered	Special Concern (Schedule 3)	Endangered	Afforded Protection

\*Species in the Twenty Mile Creek Watershed

\*\*Species in the Upper Welland River Watershed

All of the species outlined in Table 2.2 have been designated aquatic species at risk on the Department of Fisheries and Oceans (DFO) "Distribution of Aquatic Species at Risk" mapping. All watercourses that have been identified on the DFO aquatic species at risk mapping are indicated on Figures 2.2 to 2.5.

<sup>1</sup> NPCA, Email correspondence. 2010.

<sup>2</sup> DFO Distribution of Aquatic Species at Risk mapping. 2010.

<sup>3</sup> DFO Distribution of Aquatic Species at Risk mapping. 2010.



Figure 2.2: Fisheries Stream Crossing and Potential SAR





Figure 2.3: Fisheries Stream Crossing and Potential SAR





Figure 2.4: Fisheries Stream Crossing and Potential SAR

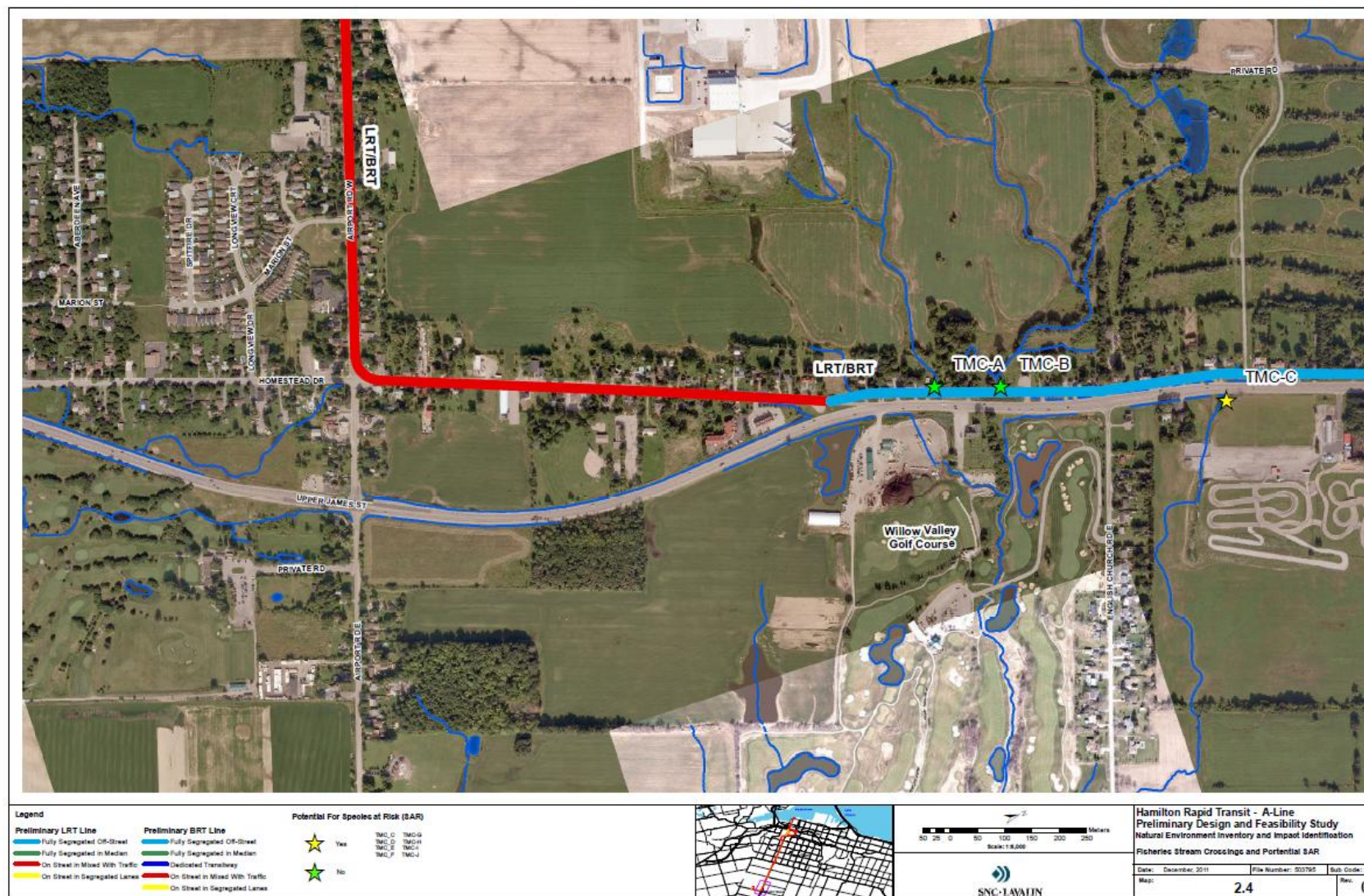
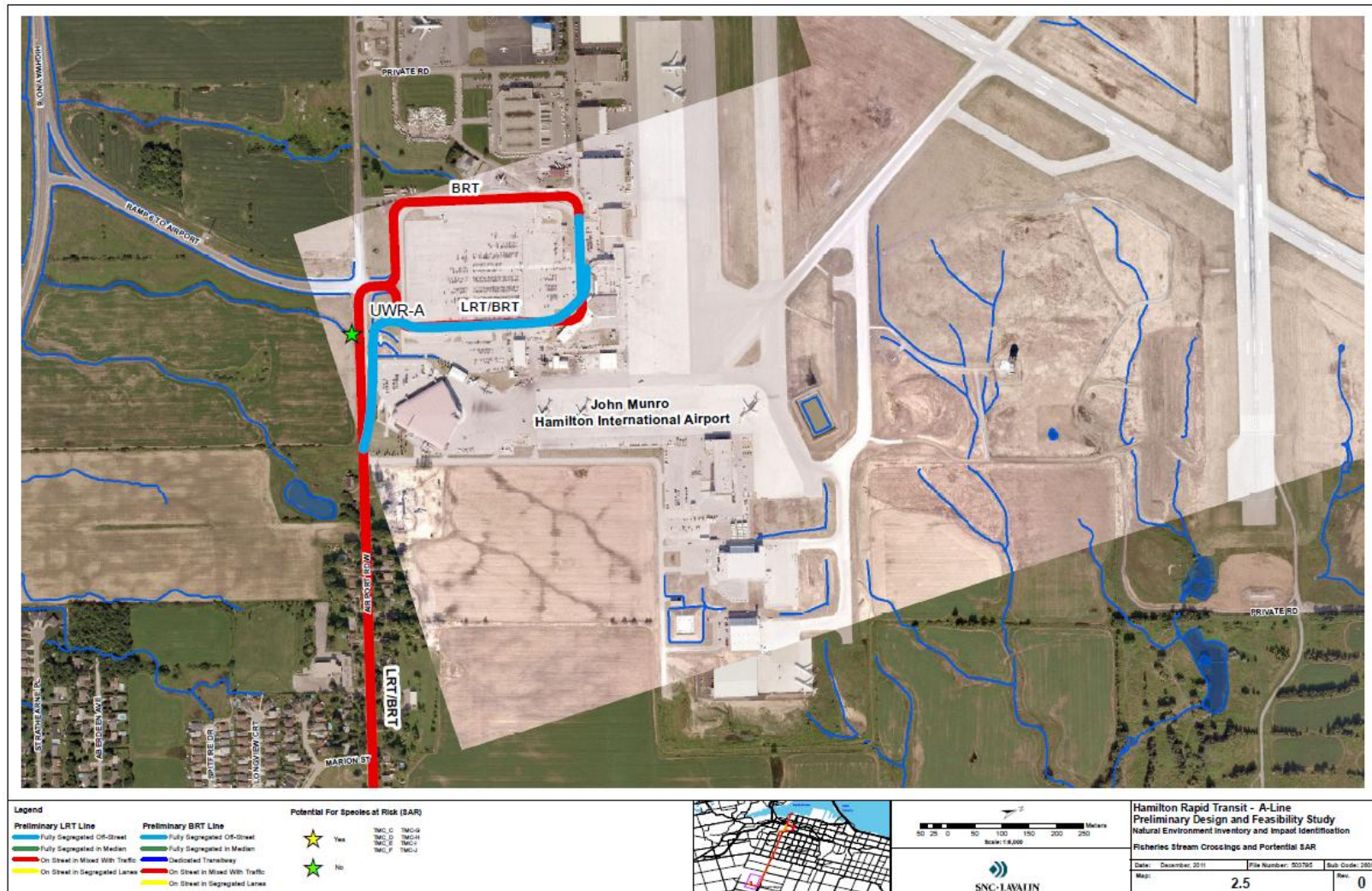




Figure 2.5: Fisheries Stream Crossing and Potential SAR



## 2.3 Aquatic Habitat Resources

### 2.3.1 City of Hamilton

#### **Aquatic Habitat**

A highly urbanized portion of the City of Hamilton (inner city core area) within the Red Hill and Spencer Creek watersheds has been excluded from the aquatic assessment, as all streams/drainage features within these areas have been integrated into the underground storm sewer network<sup>4</sup> (Figure 2.1) that discharge to Lake Ontario (Hamilton Harbour).

#### **Fish Community**

There are no fisheries resources located within this area.

### 2.3.2 Red Hill Creek Watershed

#### **Aquatic Habitat**

The A-Line route along Upper James Street crosses through the headwater area of Red Hill Creek watershed in two locations (Figure 2.1). From north to south, the A-Line corridor crosses Red Hill Creek watershed between Fennell Avenue and Mohawk Road and between Lincoln M. Alexander Parkway and the Hamilton-Glanbrook boundary, which is located north of Twenty Road West.

The Red Hill Creek watershed has experienced substantial anthropomorphic disturbance and a large proportion of the natural features once present within the A-Line corridor has long since been removed. Historically, the area was utilized for agriculture but, more recently, considerable development in the study area has resulted in significant disturbance to both terrestrial and aquatic habitats.

All of the tributaries within the Red Hill Creek watershed that cross Upper James Street have been enclosed in storm sewers to accommodate urban development, abutting the corridor. Despite this development, most downstream reaches of the watershed are natural watercourses that have permanent flow, with good to moderate habitat conditions.

There is one remaining block of land within the headwater area of Red Hill Creek that has not been developed, which is located approximately 400 m west of Upper James Street. This block is bound by Garth Street in the west, Stone Church Road in the north, Rymal Road to the south and West 5<sup>th</sup> Street as the eastern boundary. The tributaries within this block of land are headwater watercourses, which are characterized as agricultural drainage swales with intermittent flow that contribute indirectly to fish habitat located downstream.

#### **Fish Community**

All of the tributary watercourses of Red Hill Creek located within the A-Line corridor have been enclosed in storm sewers to accommodate urban development and, therefore, no fisheries resources are located directly within the study area. Downstream of the study corridor, the reaches of Red Hill Creek support a healthy and diverse warmwater fish community.

### 2.3.3 Spencer Creek Watershed

#### **Aquatic Habitat**

The Spencer Creek watershed is located west of Hamilton Harbour and covers an area of approximately 291 sq km (Figure 2.1).<sup>5</sup> From north to south, the A-Line corridor crosses the Spencer Creek watershed in two locations, from Fennell Avenue to Main Street and from Limeridge Road to approximately 600 m north of Mohawk Road.

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<sup>4</sup> Ministry of Natural Resources. 2009.

<sup>5</sup> Ministry of Natural Resources. 2009.

There is no surface water drainage features within this section of the watershed. These areas of the Spencer Creek watershed have experienced substantial human disturbance and a large proportion of the natural habitat features once present have long since been removed. All of the tributaries that cross Upper James Street have been completely enclosed in storm sewers beneath urban development.

### **Fish Community**

All of the tributaries located within the A-Line corridor have been enclosed in storm sewers to allow for urban development in the City and, therefore no fisheries resources are located directly within the study area. Similar to Red Hill Creek, downstream reaches of the watercourses within the Spencer Creek watershed support a healthy and diverse warmwater fish community.

#### **2.3.4 Twenty Mile Creek Watershed**

### **Aquatic Habitat**

The headwaters of the Twenty Mile Creek watershed are located within the A-Line study corridor. Twenty Mile Creek is considered a cool/coldwater permanent watercourse. Through the study corridor several tributaries of Twenty Mile Creek exist, conveyed in agricultural drainage channels/swales, roadside ditches, as well as some natural channels in varying states of preservation. Land use within the watershed is primarily rural but future urban development will occur in approximately 21% of the watershed.<sup>6</sup>

The headwater area for Twenty Mile Creek is located a short distance west of the study corridor and all the headwater reaches of these tributaries originate as agricultural drainage swales that provide marginal habitat, are intermittent in nature and only support fish habitat indirectly as seasonal contribution (e.g., food sources, baseflow) to downstream reaches. Within the study corridor, the tributaries are classified as seasonal warmwater watercourses that provide a combination of important and marginal habitat. Immediately downstream of Upper James Street the flow regime of these watercourses improves and they are classified as cool/coldwater containing critical habitat.

### **Fish Community**

There are ten tributaries of Twenty Mile Creek that cross the study corridor. The location of these watercourse crossings of the A-Line are shown on Figures 2.2 to 2.5. Table 2.3 provides a summary of the physical habitat attributes and fish habitat sensitivity of each watercourse.

The fish community of Twenty Mile Creek is fairly diverse, with 16 species of fish recorded, as shown in Table 2.3.

**Table 2.3: Fish Community of Twenty Mile Creek**

<b>Family</b>	<b>Scientific Name</b>	<b>Common Name</b>
<b>Cyprinidae</b>	<i>Notemigonus crysoleucas</i>	Golden shiner
	<i>Pimephales notatus</i>	Bluntnose minnow
<b>Catostomidae</b>	<i>Castostomus commersoni</i>	Common white sucker
<b>Ictaluridae</b>	<i>Ameiurus nebulosus</i>	Brown bullhead
	<i>A. melas</i>	Black bullhead
	<i>Noturus gyrinus</i>	Tadpole madtom
<b>Esocidae</b>	<i>Esox lucius</i>	Northern pike
	<i>Esox americanus vermiculatus</i>	Grass pickerel
<b>Umbridae</b>	<i>Umbra limi</i>	Central mudminnow

<sup>6</sup> Hamilton Airport Employment Growth District. 2010. Dillon Consulting.

Family	Scientific Name	Common Name
<b>Fundulidae</b>	<i>Fundulus diaphanus</i>	Banded killifish
<b>Centrarchidae</b>	<i>Lepomis gibbosus</i>	Pumpkinseed
	<i>Micropterus salmoides</i>	Largemouth bass
	<i>Ambloplites rupestris</i>	Rock bass
	<i>L. macrochirus</i>	Bluegill
	<i>Pomoxis nigromaculatus</i>	Black crappie
<b>Percidae</b>	<i>Etheostoma nigrum</i>	Johnny darter

Within the proposed A-Line corridor, Twenty Mile Creek has been assessed as warmwater, important fish habitat. The habitat is relatively common and widespread throughout the study area and does not provide any specialized spawning habitat or other habitat critical to a specific life stage of fish. The watercourses that are permanent would provide direct fish habitat to the local fish community for feeding and rearing and also provides non-specialized spawning habitat. The watercourses that are intermittent contribute indirectly to the fish habitat potential of the system, in terms of their contribution to flow and source of food for downstream habitats.

#### 2.3.5 Upper Welland River Subwatershed

##### **Aquatic Habitat**

The Welland River drains from above the Escarpment near the John C. Munro Hamilton International Airport to the Niagara River. Existing land uses are primarily rural. However, the watershed will likely see future urban development, most of which in the study area is associated with the development of a business park next to the Hamilton Airport. One small headwater tributary drains directly from the airport lands southwesterly to the confluence with the Welland River, which then drains to the Niagara River downstream of the study area.<sup>7</sup>

The headwater tributary originates within the airport lands and is likely piped for a distance under the airport and daylights approximately 20 m north of Airport Road. The watercourse is characterized as a cattail choked channel with a small, defined channel approximately 0.2 m wide and 0.05 m deep. The watercourse was flowing at the time of the field investigations in November 2011 and is likely an intermittent watercourse that provides indirect fish habitat and contributes seasonally to downstream habitats.

##### **Fish Community**

There are no fisheries data available for the headwater tributaries of the Upper Welland River subwatershed.<sup>8</sup>

#### 2.3.6 Summary of Fish Habitat Sensitivity and Constraints

As part of the aquatic habitat assessment for the A-Line, a determination of fish and fish habitat sensitivity for the watercourses in the study area was completed. This categorization of sensitivity encompassed both fish species and fish habitat, and their inter-relationships and dependencies. While an understanding of the component species and habitat requirements is important to assessing sensitivity, the interactions at the fish community and overall aquatic ecosystem levels must be integrated in the analysis. The attributes used for assessing the sensitivity of fish and fish habitat included:

- Species Sensitivity

<sup>7</sup> Dillon Consulting. 2010.

<sup>8</sup> Niagara Peninsula Conservation Authority. 2010.

- Species' Dependence on Habitat
- Rarity
- Habitat Resiliency

The above attributes and process for determining fish habitat sensitivity are consistent with the approach documented in the *Guide to the Risk Management Framework for DFO Habitat Management Staff Practitioners* (Version 1.0, DFO).

From the SLI aquatic habitat assessment and the approach outlined above for determining sensitivity, the tributaries within the Spencer Creek and Red Hill Creek Watersheds do not support fish habitat and, therefore, are considered to have low sensitivity.

The permanent tributaries within the Twenty Mile Creek and Upper Welland River Watersheds in the study area provide direct fish habitat and these watercourses have been classified as exhibiting moderate sensitivity. The intermittent tributaries provide indirect fish habitat through flows and allochthonous inputs to downstream reaches, and these reaches are considered to have low sensitivity. Key factors in this determination include:

- The headwater watercourses contribute flows and allochthonous energy inputs to downstream reaches, indirectly supporting a warmwater fish community;
- The habitat is considered to be common within the watershed;
- species are not dependent on the habitat for any life stage (i.e., migration, spawning);
- Twenty Mile Creek tributaries and the Upper Welland River tributaries are classified as warmwater fisheries and are able to tolerate or recover from changes in environmental conditions, such as flow and thermal regime.

The main branch of Twenty Mile Creek (TMC-I) is classified as exhibiting high sensitivity<sup>9</sup>. This watercourse contributes indirectly to downstream habitats, is warmwater and does not provide any specialized spawning habitat or a migratory corridor. This watercourse has high habitat resiliency and would be able to tolerate and/or recover from changes in environmental conditions, such as flow and thermal regime.

## 2.4 Aquatic Effects Assessment

### 2.4.1 Potential Aquatic Impacts and Mitigation Measures

Works in and around water features containing fish and fish habitat have the potential to result in the harmful alteration, disruption or destruction (HADD) of fish habitat, as defined in the *Fisheries Act*. HADD includes any changes that prevent the physical, biological or chemical attributes of fish habitat from providing food, reproduction, cover and movement corridors, or any change in fish habitat that reduces its capacity to support one or more of life processes of fish (DFO 1998).

The proposed A-Line RT system may have the potential to adversely affect the aquatic environment and surface water quality, particularly where the alignment is located outside the bounds of existing streets (from south of Rymal Road to the intersection of Upper James Street and Homestead Drive, where the route runs on a segregated alignment on the west side of Upper James Street). The proposed construction activities for the RT system may involve in-water work at the watercourses along Upper James Street and may include works such as culvert extensions, excavation, excess material storage, equipment maintenance activities and wastewater management and, therefore, does have the potential to directly impact fish habitat by altering/removing natural physical features that constitute habitat (i.e., channel bed, substrates, riparian vegetation, in-stream cover, etc.). Potential impacts to fish include impairment of water quality, and direct fish kills or destruction of habitat due to spills/discharges (e.g., chemical or sediment), resulting in short term population decline.

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<sup>9</sup> NPCA, Email correspondence, 2010.



### **Mitigation Measures**

Environmental design and construction mitigation measures identified in the preliminary design phase as part of this study to avoid and/or minimize potential impacts to the aquatic environment and surface water include:

- For extensions of existing culverts including the following tributaries that are within the Twenty Mile Creek watershed:
  - TMC-A
  - TMC-B
  - TMC-C
  - TMC-E
  - TMC-F
  - TMC-G
  - TMC-H
  - TMC-I
  - TMC-J
- The culvert extensions will be designed and constructed to retain elements of fish habitat within the structure (i.e., natural substrate, open bottom culvert, groundwater upwelling, channel width, water depths, slope, channel morphology characteristics) and enhance fish passage, where feasible;
- Watercourse realignments, if required, will be designed using natural channel design and fluvial geomorphology principles with treatments to restore and enhance fish habitat;
- Design and implementation of temporary flow diversion schemes to isolate in-water work area and maintain clean flow around work zone at all times. (e.g., by-pass pumping, fluming);
- Design and installation of native woody and herbaceous riparian vegetation to pre-construction conditions or better at watercourses;
- Transfer any fish isolated in work areas using appropriate capture, handling and release techniques to prevent harm;
- Implement warmwater construction timing restrictions for in-water work applicable at the time of construction, as identified by MNR, to protect sensitive life stages of fish;
- Design and implement erosion and sediment controls measures, such as straw bale flow checks, silt fence barriers, and temporary rock flow checks, to prevent erosion of exposed soils and migration of sediment to watercourses, including:
  - Stabilize and re-vegetate exposed soils immediately following construction.
  - Conduct work in a continuous fashion to minimize the duration of potential impacts and maintain the area of disturbance to a minimum.
- Design temporary and permanent drainage and stormwater management systems to mimic overland drainage patterns and control runoff quality/quantity contribution to watercourse features;
- Store, handle and dispose of all excess materials by storing, handling and disposing of all materials generated during site preparation, construction and operations in a manner that will prevent their entry into watercourses, including:
  - Place temporary stockpiles of material a minimum of 30 m away from watercourses and ensure material is stabilized to prevent sediment laden runoff from entering watercourses.
  - Prepare a spill/emergency response plan for construction and operations.
- Manage dewatering and concrete effluent, where applicable, from excavations and structural works to prevent release of contaminated water to receiving watercourses, including:
  - Direct dewatering effluent to temporary settling basins, filter bags and energy discharge diffusers, as required.



- Capture and transport concrete effluent off-site for disposal.
- Operate, maintain and store all equipment and materials (e.g., fuel, lubricants) in a manner that prevents the entry of any deleterious substances to watercourses;
- Ensure that equipment re-fuelling and maintenance will take place no closer than 30 m from any watercourse to prevent water contamination due to accidental spills/discharge of toxic materials; and
- Prohibit/limit construction access to watercourse/watercourse banks.

#### 2.4.2 Scale of Negative Effects and Net Residual Effects

Remaining (residual) effects after the application of mitigation measures were assessed in terms of the resulting Scale of Negative Effect (extent, duration, and intensity) in the context of the fish habitat being affected (i.e., the sensitivity of fish and fish habitat). The DFO Risk Management Framework, which incorporates the above two factors (i.e., Scale of Negative Effect and Sensitivity of Fish/Fish Habitat), was used to characterize the potential level of risk (high, medium or low) that any residual effects after the application of mitigation might pose to fish/fish habitat, and thus the likelihood of a HADD or No HADD occurring as a result of the proposed work in the preliminary design stage for the A-Line RT system. Results from this assessment were then used to help determine whether the works could result in the HADD of fish habitat, as defined under the *Fisheries Act*.

The A-Line corridor passes through the jurisdiction of two conservation authorities, namely HCA and the NPCA. The HCA jurisdiction includes Red Hill Creek and Spencer Creek watersheds, while NPCA's jurisdiction includes Twenty Mile Creek and the Upper Welland River watersheds. Both HCA and NPCA have a Level 2 Agreement in place with the DFO. In accordance with these agreements, the HCA and NPCA will complete an aquatic effects assessment using the DFO's Risk Management Framework to determine potential impacts of the proposed work on fish and fish habitat. From the aquatic effects assessment completed as part of this study, it is expected the proposed work associated with the A-Line RT system will be characterized by HCA and NPCA as having a "Low Risk" of resulting in a HADD of fish habitat in watercourses within their respective watersheds. Therefore, it is anticipated that the HCA and NPCA will make a determination of no HADD of fish/fish habitat for the project.

Overall, the extent and nature of the disturbance associated with the preliminary design proposal for the A-Line RT system at the subject watercourses is expected to have negligible long term effects on fish and fish habitat, provided that appropriate environmental protection and mitigation/restoration measures are applied. Therefore, no significant residual effects to surface water and aquatic resources are anticipated from the project. It is recommended that HCA and NPCA be engaged in a consultative and collaborative manner during future design phases to seek confirmation of the HADD/No HADD of fish/fish habitat at each of the watercourse crossings.

### **3.0 TERRESTRIAL WILDLIFE AND SIGNIFICANT VEGETATION**

#### **3.1 Introduction**

The purpose of this section is to report on the review of available background information on Terrestrial Ecosystems, and the high-level impact assessment, and to provide input to a mitigation strategy for terrestrial and wetland wildlife and significant vegetation species in natural areas along the A-Line corridor.

The first part of this section provides a summary of available background information on the wildlife species known from the vicinity of the proposed A-Line corridor, identifies wildlife habitat areas potentially affected by the A-Line corridor, and provides initial recommendations for mitigation of potential effects. The second part reviews the background information of the significant vegetation to describe ecological landscapes, vegetation communities, and the potential for rare or endangered species. This information is summarized in order to identify any environmental constraints present and to guide the development of the proposed Rapid Transit system in the A-Line corridor.

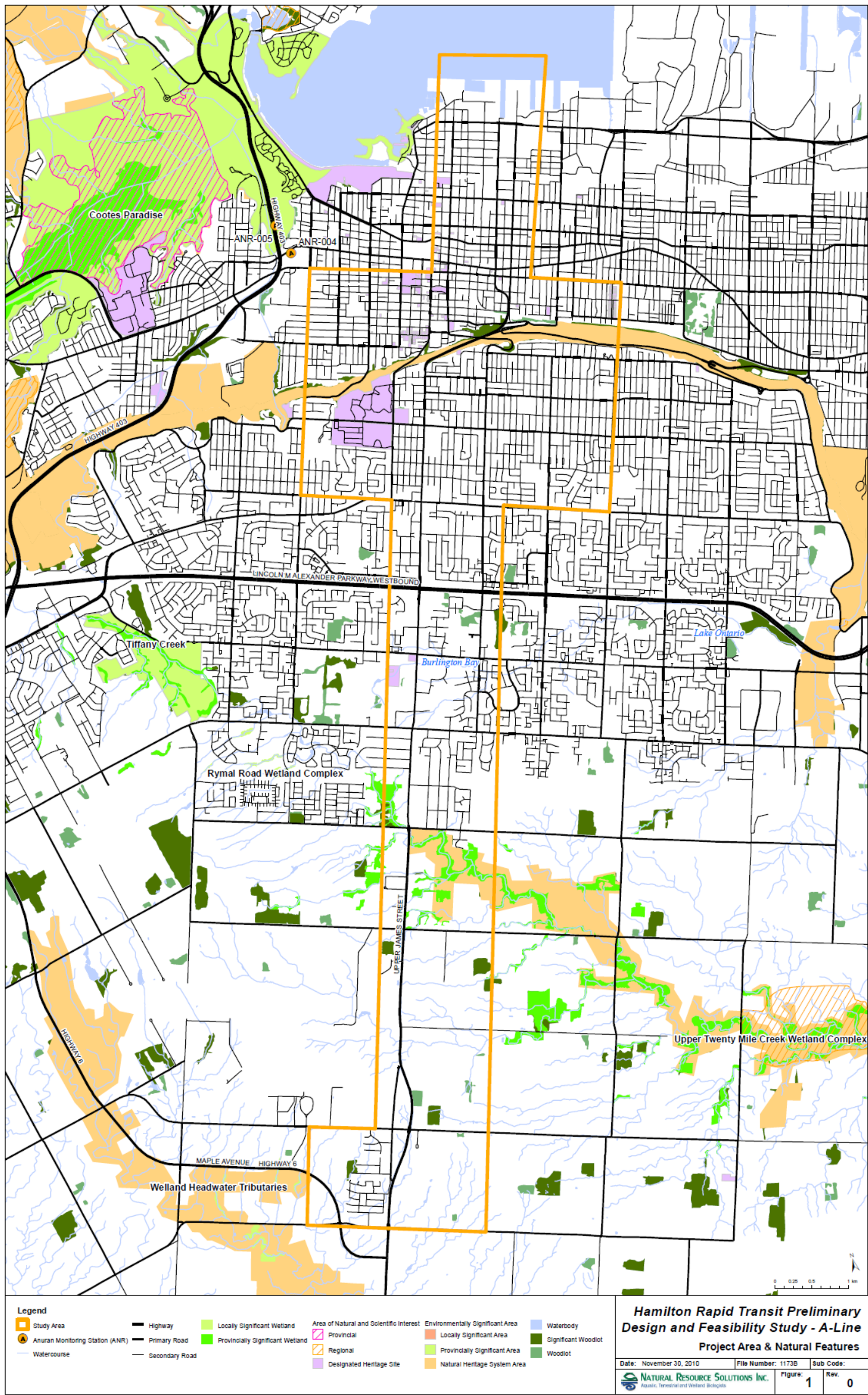
At this point, the design is very preliminary. The purpose of this report is to document existing conditions and identify any known sensitivities along the proposed route to provide input into future design design phases of the project.

#### **3.2 Terrestrial Wildlife**

##### **3.2.1 Project Area**

For the purposes of this report, the term 'project area' refers to the area of Hamilton, Ontario along the A-Line corridor between the Hamilton Harbour waterfront in the north, and John C. Munro Hamilton International Airport in the south (Appendix A). The term 'study area' refers to the project area plus the surrounding area (approximately 1 km) (refer to Figure 3.1). The study area is characterized by an urban gradient, from the industrial/urban core in the north, residential/suburban land uses in the central portion, and rural/recreational lands in the south.

Figure 3.1: Study Area



### 3.3 Study Methods

#### 3.3.1 Collection and Review of Background Information

Background information on the natural environmental features within the study area was gathered from the Natural Heritage Information Centre (NHIC) Biodiversity Explorer database (OMNR, 2010).

Species lists were compiled to provide information on wildlife species known from the local vicinity using various atlases, including the Ontario Mammal Atlas (Dobbyn, 1994), Ontario Breeding Bird Atlas (OBBA) (Cadman et al., 2007), and the Ontario Herpetofaunal Summary Atlas (Oldham and Weller, 2000). The NHIC Biodiversity Explorer database (OMNR, 2010) was searched for information regarding provincially rare species. All wildlife species known to occur within the vicinity of the study area were cross-referenced with updated listings of species identified as nationally significant (COSEWIC, 2009) or provincially significant (OMNR, 2009).

Data on breeding birds in the study area were extracted from the OBBA. Since the OBBA provides data based on 10x10 km survey squares, information on breeding birds from all squares that overlap the study area were compiled (squares 17NH87, 17NH88, 17NH98, and 17NH99).

The MNR's online Biodiversity Explorer provides records of rare species of wildlife and plants for geographic areas. Because this information is not sorted by taxa, we have provided both the plant data in this report, as well as the wildlife data that was obtained.

#### 3.3.2 Field Work

NRSI biologists conducted a visit to the study area on October 15<sup>th</sup>, 2010. The purpose of this visit was to identify any natural vegetation communities within the study area, and generally assess their potential for providing wildlife habitat.

### 3.4 Existing Conditions

#### 3.4.1 Soils and Terrain

The following is a summary of the information provided in the soil maps of Wentworth County (Presant et al., 1965):

The northern portion of the study area is located on the Queenston formation, which is of Ordovician age. It is the oldest formation in the County, and occupies the area from the base of the Niagara Escarpment to the Lake Ontario shoreline. The Queenston rocks consist of red mudstone with occasional greenish siltstone bands. It weathers rapidly into a cohesive, reddish soil on exposure to the atmosphere.

The gently sloping area, which extends from Lake Ontario to an elevation of about 350 ft., has been called the Iroquois Plain, because it was once covered by glacial Lake Iroquois. It consists of weathered red shale overlain by lenses of clay till and lacustrine sand. Drainage is slow where the sand is absent or very shallow. The ravines in this area have only a few, short tributaries, and their main contribution to the local drainage is to provide outlets for tile drains.

To the south, the Escarpment is capped by the resistant Silurian dolomites of the Lockport and Amabel formations, which consist of white, gray, and brown dolomites. The Lockport formation provides the bedrock surface immediately south of (above) the Escarpment. Even further south of the Escarpment is the Guelph formation, which provides the bedrock surface for a very large area and consists of light gray, buff-weathered dolomites.

Above the Escarpment, the relief and drainage are partly controlled by the resistant underlying dolomite bedrock. The area includes flat clay and bedrock plains and broad meandering stream valleys.

#### 3.4.2 Wildlife

### **Birds**

A comprehensive bird species list of background information from the OBBA (Cadman et al., 2007) can be found in Appendix B. A total of 141 bird species are known from the four 10x10 km squares (17NH87, 17NH88, 17NH98, and 17NH99) that overlap with the study area, according to the OBBA. Most of these species lack suitable breeding habitat within the study area. A review of the NHIC Biodiversity Explorer database has also identified a historic record of northern bobwhite (*Colinus virginianus*) from the vicinity of the study area. However, this provincially and federally Endangered species was last observed in the area in 1904 (OMNR, 2010). As such, it is accepted that northern bobwhite no longer inhabits the study area.

Background information from the OBBA indicates that 16 significant bird species are recently known from the vicinity (approximately 10 kilometres) of the study area. These species, their habitats, and the likelihood of finding them in the study area are described in Table 3.1 below. Based on aerial imagery and on-site observations, it is assumed that the study area may contain suitable habitat for barn owl (*Tyto alba*), bobolink (*Dolichonyx oryzivorus*), chimney swift (*Chaetura pelagica*), common nighthawk (*Chordeiles minor*), and red-headed woodpecker (*Melanerpes erythrocephalus*), while it is known to contain habitat for peregrine falcon (*Falco peregrinus anatum/tundrius*).



Table 3.1: Significant Bird Species Recorded in the Vicinity of the Study Area

Common Name	Scientific Name	S-Rank <sup>1</sup>	COSEWIC status <sup>2</sup>	SARO status <sup>3</sup>	Preferred Habitat <sup>4</sup>	Habitat within study area?
Redhead	<i>Aythya americana</i>	S2B, S4N			shallow cattail/bulrush marshes, lakes and ponds and fens; preferred nesting usually close to shallow water (most within 2 metres), but can be found as far as 266 metres from water's edge	No
Red-necked Grebe	<i>Podiceps grisegena</i>	S3B, S4N	NAR	NAR	permanent freshwater lakes with a fringe of aquatic emergent vegetation; marshes, impoundments or sewage lagoons with > 4 ha of open water; protected marshy areas or bays in larger lakes;	No
Least Bittern	<i>Ixobrychus exilis</i>	S4B	THR	THR	deep marshes, swamps, bogs; marshy borders of lakes, ponds, streams, ditches; dense emergent vegetation of cattail, bulrush, sedge; nests in cattails	No
Black-Crowned Night Heron	<i>Nycticorax nycticorax</i>	S3B, S3N			deciduous woodland swamps, cattail marshes, islands, wooded river and lake banks, coastal wetlands	No
Bald Eagle	<i>Haliaeetus leucocephalus</i>	S2N, S4B	NAR	SC	require large continuous area of deciduous or mixed woods around large lakes, rivers; require area of 255 ha for nesting, shelter, feeding, roosting; prefer open woods with 30 to 50% canopy cover; nest in tall trees 50 to 200 metres from shore; require tall, dead, partially dead trees within 400 metres of nest for perching	No
Peregrine Falcon	<i>Falco peregrinus anatum/tundrius</i>	S3B	SC	THR	rock cliffs, crags, especially situated near water; tall buildings in urban centres;	Yes
Great Black-backed Gull	<i>Larus marinus</i>	S2B			flat rocky coastal islands, moorlands, rocky beaches, cliffs; nest is solitary or in small (rarely large) colonies	No
Barn Owl	<i>Tyto alba</i>	S1	E	END	open areas such as fields, agricultural lands with scattered woodlots, buildings and/or orchards; grasslands, sedge meadows,	Yes

Common Name	Scientific Name	S-Rank <sup>1</sup>	COSEWIC status <sup>2</sup>	SARO status <sup>3</sup>	Preferred Habitat <sup>4</sup>	Habitat within study area?
					marshes; nests in hollow trees and live trees >46 cm dbh; also nests in barns, abandoned buildings	
<b>Common Nighthawk</b>	<i>Chordeiles minor</i>	S4B	THR	SC	open ground; clearings in dense forests; ploughed fields; gravel beaches or barren areas with rocky soils; open woodlands; flat gravel roofs	Yes
<b>Chimney Swift</b>	<i>Chaetura pelagica</i>	S4B, S4N	THR	THR	commonly found in urban areas near buildings; nests in hollow trees, crevices of rock cliffs, chimneys	Yes
<b>Red-headed Woodpecker</b>	<i>Melanerpes erythrocephalus</i>	S4B	THR	SC	open, deciduous forest with little understory; fields or pasture lands with scattered large trees; wooded swamps; orchards, small woodlots or forest edges; groves of dead or dying trees	Yes
<b>Golden-winged Warbler</b>	<i>Vermivora chrysoptera</i>	S4B	THR	SC	early successional habitat; shrubby, grassy abandoned fields with small deciduous trees bordered by low woodland and wooded swamps; alder bogs; deciduous, damp woods; shrubby clearings in deciduous woods with saplings and grasses; brier-woodland edges; requires >10 ha of habitat	No
<b>Louisiana Waterthrush</b>	<i>Seiurus motacilla</i>	S3B	SC	SC	prefers wooded ravines with running streams; also woodlands swamps; large tracts of mature deciduous or mixed forests; canopy cover is essential; has strong affinity to nest sites; nests on ground	No
<b>Hooded Warbler</b>	<i>Wilsonia citrina</i>	S3B	THR	SC	favours mature, deciduous forest (Carolinian), particularly along stream bottoms, ravine edges and where saplings and shrubby grow; nests above ground in small shrubs; feeds on or near ground	No
<b>Yellow-breasted Chat</b>	<i>Icteria virens</i>	S2B	SC (ssp. <i>virens</i> )	SC	thickets, tall tangles of shrubby beside streams, ponds; overgrown bushy clearings with deciduous thickets; nests above ground	No



Common Name	Scientific Name	S-Rank <sup>1</sup>	COSEWIC status <sup>2</sup>	SARO status <sup>3</sup>	Preferred Habitat <sup>4</sup>	Habitat within study area?
<b>Bobolink</b>	<i>Dolichonyx oryzivorus</i>	S4B	THR		in bush, vines etc. large, open expansive grasslands with dense ground cover; hayfields, meadows or fallow fields; marshes; requires tracts of grassland >50 ha	Yes

<sup>1</sup>OMNR 2010; <sup>2</sup>COSEWIC 2009; <sup>3</sup>OMNR 2009; <sup>4</sup>OMNR 2000.

S1- Critically Imperiled, S2- Imperiled, S3- Vulnerable, S4- Apparently Secure, (N- Non-breeding, B- Breeding)

NAR- Not at Risk, THR- Threatened, SC- Special Concern, E and END - Endangered

### **Herpetofauna**

Twenty-nine species of herpetofauna (reptiles and amphibians) are known to occur within the vicinity of the study area according to the Ontario Reptile and Amphibian Atlas (Ontario Nature, 2011). A complete list of herpetofauna known from the study area, including their current status rankings, is shown in Appendix C. Refer to Table 3.2 below for the eight significant species known from the study area, their preferred habitat, and the likelihood of them inhabiting the study area. Based on aerial imagery and on-site observations, the study area may provide suitable habitat for common snapping turtle (*Chelydra serpentina serpentina*), eastern musk turtle (*Sternotherus odoratus*), eastern milksnake (*Lampropeltis t. triangulum*), Jefferson salamander (*Ambystoma jeffersonianum*) and the Great Lakes/St. Lawrence-Canadian Shield population of western chorus frog (*Pseudacris triseriata*).

Table 3.2: Significant Reptile and Amphibian Species Known from the Vicinity of the Study Area.

Common Name	Scientific Name	S-Rank <sup>1</sup>	COSEWIC Status <sup>2</sup>	SARO Status <sup>3</sup>	Preferred Habitat <sup>4</sup>	Habitat within subject property?
Eastern Spiny Softshell	<i>Apalone spinifera spinifera</i>	S3	THR	THR	large river systems, shallow lakes and ponds with muddy bottoms and aquatic vegetation; basks on sandbars, mud flats, grassy beaches, logs or rocks; eggs are laid near water on sandy beaches or gravel banks	No
Common Snapping Turtle	<i>Chelydra serpentina serpentina</i>	S5	SC	SC	permanent, semi-permanent fresh water; marshes, swamps or bogs; rivers and streams with soft muddy banks or bottoms; often uses soft soil or clean dry sand on south-facing slopes for nest sites	Yes
Blanding's Turtle (Great Lakes/St Lawrence population)	<i>Emydoidea blandingii</i>	S3	THR	THR	shallow water marshes, bogs, ponds or swamps, or coves in larger lakes with soft muddy bottoms and aquatic vegetation	No
Eastern Musk Turtle	<i>Sternotherus odoratus</i>	S3	THR	THR	Shallow, slow-moving water of lakes, streams, marshes and ponds; hibernates underwater in mud, in banks or muskrat lodges; nests laid in debris or under logs	Yes
Northern Map Turtle	<i>Graptemys geographica</i>	S3	SC	SC	Large water bodies with soft bottoms, and aquatic vegetation; basks on logs or rocks, or on beaches with grassy edges; uses soft soil or dry sand for nest sites	No
Eastern Milksnake	<i>Lampropeltis t. triangulum</i>	S3	SC	SC	farmlands, meadows, hardwood or aspen stands; pine forest with brushy or woody cover; river bottoms or bog woods	Yes
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	S2	END	THR	damp shady deciduous forest, swamps, moist pasture, lakeshores; temporary woodland pools for breeding	Yes
Western Chorus Frog (Great Lakes/St. Lawrence-Canadian Shield population)	<i>Pseudacris triseriata</i>	S3	THR	NAR	roadside ditches or temporary ponds in fields; swamps or wet meadows; woodland or open country with cover and moisture; small ponds and temporary pools	Yes

<sup>1</sup>OMNR 2010; <sup>2</sup>COSEWIC 2009; <sup>3</sup>OMNR 2009; <sup>4</sup>OMNR 2000.

S1- Critically Imperiled, S2- Imperiled, S3- Vulnerable, S4- Apparently Secure, (N- Non-breeding, B- Breeding)

NAR- Not at Risk, THR- Threatened, SC- Special Concern, E- Endangered,

## **Mammals**

Twenty-two mammal species are known from the vicinity of the study area based on information from the *Mammal Atlas of Ontario* (Dobbyn, 1994), all of which are common species in Ontario. A complete list of mammal species known from the study area, including their current status rankings, is shown in Appendix D. In addition, a review of the NHIC Biodiversity Explorer database identified records of woodland vole (*Microtus pinetorum*) from the vicinity of the study area. This provincial and federal species of Special Concern's preferred habitat includes mature Carolinian deciduous forests, grasslands, meadows, and orchards with groundcover of duff or grass (OMNR 2000). Such meadow and orchard habitats are limited, but present, in the southern portion of the study area. Mammal inventories, including small mammal trapping, conducted in the Hamilton region over the past 60 years have not conclusively identified the presence of woodland vole (Vlasman, 2003). Given that the most recent local record of this species occurred in 1951, it is very unlikely that woodland vole inhabits the study area (OMNR, 2010).

## **3.5 Impact Assessment and Mitigation**

### **3.5.1 Significant Wildlife**

The fully-segregated off-street A-Line component along the west side of Upper James Street is planned to run adjacent to the existing ROW where it crosses the Upper Twenty Mile Creek PSW complex. Specifically, the off-street component is to run adjacent to the majority of the wetland complex where it occurs within the study area, but will intercept the wetland just west of where Twenty Mile Creek crosses under Upper James Street at Twenty Road (Appendix A, Figures 3, 6). Therefore, this segment of the corridor will impact a small portion of the PSW, such as through direct habitat loss, at this location. This PSW may provide habitat for aquatic-dependent species, such as common snapping turtle, eastern musk turtle, Jefferson salamander, and western chorus frog. Grassy and open woodland upland areas surrounding the wetland may also provide habitat for eastern milksnake, barn owl and common nighthawk.

Indirect impacts on the wetland and its resident species may also occur from increases in sediment-laden stormwater runoff and erosion during and following construction. Increased inputs of nutrients, chlorides, and sediments in stormwater runoff may degrade water quality within the wetland and impair its capacity to provide critical life-stage functions for wildlife. For example, alterations to wetland vegetation and aquatic macroinvertebrate species assemblages caused by eutrophication over time can affect availability of appropriate wildlife food sources. These pollutants, as well as other toxic compounds that may occur in stormwater runoff (e.g., PAHs), may also impair reproductive success, or cause mortality, in sensitive semi-aquatic species such as amphibians, as well as other organisms. Increased disturbance caused by excessive noise, vibration, and proximity of human presence during construction may cause certain significant wildlife species (e.g., barn owl) to abandon or avoid the area for nesting or foraging. However, wildlife that currently use this wetland and its surrounding upland habitat will have been already accustomed to some level of existing disturbances in surrounding lands, such as those caused by vehicular traffic on adjacent streets.

Vegetation removal and design footprint area will be minimized to the extent possible where the off-street corridor is to intercept the PSW at Twenty Road. Doing so will lessen direct impacts on the functional integrity of the wetland. Vegetation removal will occur outside of the bird breeding season (April 24 - August 8) to limit impacts on these species. If vegetation removal must occur during the bird breeding season, a qualified terrestrial biologist must be retained to search the area for active nests prior to clearing. Where feasible, barriers to wildlife movement into the active construction area will be required. Silt fencing can be used to exclude wildlife around the perimeter of construction areas, and can be configured to funnel wildlife movements to a pre-determined crossing location away from areas of active construction. In conjunction with barrier fencing, wildlife rescue is recommended to remove individuals (fish, frogs, toads, turtles, etc.) that occur in open water habitats within the construction zone.

Where feasible, existing road culverts in the vicinity of the PSW will be modified to serve as wildlife passages, directed toward appropriate habitat on the opposite side of the ROW. Drift/funnel fencing will be installed to direct wildlife movements toward the passage opening. Wildlife passage structures and associated drift/funnel fencing will be designed to target herpetofauna and small mammal species that reside within and around the PSW. These structures will help mitigate impacts on significant wildlife species that may inhabit the PSW,



such as Jefferson salamander and western chorus frog, by providing a safe alternative to crossing an expanded ROW, and thus lessening the potential for road mortality. Wildlife crossing structures will also provide a means to retain connectivity of the PSW with surrounding habitat features for small mammals and herpetofauna. This will help to maintain biodiversity within the wetland complex and allow for animal movements integral to sustainability of local populations (e.g., the “rescue” of a diminished local amphibian population by immigration of individuals from neighbouring habitats). The details of wildlife passage location, design, and an associated plan for pre-, during-, and post-construction monitoring (e.g., incorporating road mortality surveys, pitfall trapping, amphibian call surveys) will be determined in consultation with appropriate regulatory agencies (e.g., City of Hamilton, Hamilton Conservation Authority, Ontario Ministry of Natural Resources).

As a further means of mitigation, a Sediment and Erosion Control Plan will be created to establish where silt fencing is installed around construction area boundaries to capture sediment-laden runoff, and limit erosion and sedimentation of adjacent natural features. The silt fencing must be inspected on a regular basis to ensure it is functioning as required, and will be replaced as necessary due to loss or damage of materials. This silt fencing may also serve to provide the wildlife barriers described above, if deemed feasible. The Sediment and Erosion Control Plan could also incorporate at least one year of post-construction monitoring for water quality and macroinvertebrate indicator species condition to track success of mitigation measures.

### **Birds**

Peregrine falcons are known to nest on tall buildings in urban areas, and a pair has nested on the Hamilton Sheraton Hotel located at the intersection of King Street and Bay Street, within the study area since 1995. These birds are well accustomed to day-to-day street-level disturbances and construction activities associated with a busy urban area.

Chimney swifts nest in chimneys in urban areas and common nighthawks can nest on flat, gravel roofs. The study area includes numerous buildings in the urban areas that represent potential chimney swift and common nighthawk nesting habitat. The A-Line is generally restricted to existing transportation corridors within urbanized regions of the study area, with the exception of where a fully segregated off-street component occurs along the west side of West 5<sup>th</sup> Street. This proposed segment would occur entirely within the manicured lawn of the St. Joseph’s Healthcare Hamilton West 5<sup>th</sup> campus. Therefore, the proposed development will not likely impact any potential chimney swift nesting structures, and they should not be impacted by the development (Dillon Consulting Ltd. 2009).

However, common nighthawks also nest in natural features including open ground, ploughed fields, and open woodland. These habitat features exist in the south (rural) end of the study area, where a fully segregated off-street component of the A-Line is to occur along the west side of Upper James Street. Potential common nighthawk habitat will thus be impacted by the proposed development through habitat loss. However, the proposed off-street segment will occur immediately adjacent to the existing ROW and it is unlikely that critical (nesting) habitat for this species occurs along a busy rural roadway given the availability of suitable habitat further set-back from the roadway. Therefore, it is unlikely that common nighthawk nesting habitat will be directly impacted by the proposed development.

In the southern portion of the study area, barn owl may potentially inhabit the agricultural fields and scattered woodlots, and bobolink may inhabit the few small hayfields. Appropriately-timed field surveys will be required to verify the presence of these species or their critical habitat (e.g., nesting, foraging) within and adjacent to the design footprint area. If these species are determined to be using the affected habitat, a permit under Section 17(2)(c) of the ESA will be required to provide for impact mitigation, compensation, and a strategy for overall benefit to the species. In the event that habitats of ESA-regulated species are identified, appropriate protective measures will be implemented following habitat regulations established by the OMNR. For example, barn owl nesting or roosting sites, as well as 25 metres area around the base of natural features used as those sites, will receive protection for 12 months after their last use (OMNR 2011).

Red-headed woodpecker could potentially breed in the narrow section of the Hamilton Escarpment Environmental Significant Area (ESA) located within the study area. However, as A-Line development activities will remain within the existing infrastructure footprint of the Claremont Access where it passes through the ESA, this habitat should not be impacted. Red-headed woodpecker may also occur within the

open agricultural areas and small woodlands that occur in proximity to the proposed fully-segregated off-street A-Line component abutting the west side of Upper James Street. However, because critical (nesting) habitat for this species is unlikely to currently occur immediately adjacent to Upper James Street, the proposed development is not expected to directly impact this species.

Where the fully-segregated off-street component of the A-Line is to occur adjacent to Upper James Street in the south end of the study area, there is potential for indirect impacts to barn owl, common nighthawk, bobolink, and red-headed woodpecker within nearby surrounding appropriate habitats due to temporary construction activities (e.g., noise, dust, proximity of human and large machinery presence). Therefore, if possible, construction activities should occur outside the bird breeding season (April 24 - August 8) to lessen potential impacts on these species. If clearing/grubbing must occur during the breeding season and nests are encountered, a qualified biologist must be retained to inspect the nest and remove it, if necessary.

### **Herpetofauna**

Eastern milksnake, common snapping turtle, eastern musk turtle, Jefferson salamander, and western chorus frog (Great Lakes/St. Lawrence-Canadian Shield population) may occur within the Upper Twenty Mile Creek PSW complex. See section 3.5 for discussion about impacts and recommended mitigation measures affecting herpetofauna and other significant wildlife species that may use the PSW.

Eastern milksnake may also potentially inhabit the agricultural lands and open woodlands in the south end of the study area, while Jefferson salamander and western chorus frog may also inhabit moist deciduous forest fragments, small ponds and temporary pools in that area. Because the fully-segregated off-street component of the corridor closely abuts the existing ROW, it is not expected that critical nesting or overwintering habitat for eastern milksnake will be impacted. Appropriate habitat for these critical life-cycle stages may be provided away from the ROW where disturbances are lessened.

The proposed RT system is not expected to impact critical habitat associated with Jefferson salamander or western chorus frog, as their required habitat features do not currently exist alongside the current ROW where the proposed development is to occur.

A review of the NHIC Biodiversity Explorer database has also identified a historic record of timber rattlesnake (*Crotalus horridus*) from the vicinity of the study area. However, this species has been extirpated and was last observed in the area in 1950 (OMNR, 2010). As such, it is accepted that timber rattlesnake no longer inhabits the study area.

If any herpetofaunal species, particularly snakes or turtles, are encountered during construction, work should be halted and a qualified terrestrial biologist should be contacted immediately to ensure that the appropriate agencies are notified and arrangements are made for these species to be relocated.

### **Mammals**

Woodland vole, a species of special concern provincially and federally, is known from the study area, although the most recent record of this species occurred in 1951. Consequently it is unlikely that this species presently occurs within the study area. Furthermore, the appropriate grassy meadow and open woodland habitat that may be removed for the proposed off-street A-Line segment on the west side of Upper James Street constitutes a very small proportion of the habitat available in the surrounding landscape. Therefore, no impacts on this species are anticipated, provided that the species does occur within the study area.

### 3.6 Significant Vegetation

#### 3.6.1 Project Area Characterization

From the perspective of assessing the natural vegetation component, an initial review of aerial photography available for the project area indicated that the majority of the northern portion of the corridor is an urban section of downtown Hamilton, with intense urban development extending south from the start of the route to Twenty Road. With the exception of the Niagara Escarpment, habitat and vegetation on either side of the proposed LRT and BRT alignments, north of Twenty Road, consists of manicured open space, lawns, and planted trees. The remainder of the alignment is bounded by active agriculture land, and rural residential uses, with some remnant woodlots and wetland pockets associated with Twenty Mile Creek and its tributaries.

### 3.7 Methods

Background information was reviewed in order to describe:

- Ecological landscape setting of the study area;
- General plant and faunal species/communities in potentially affected areas;
- Potential for rare or endangered species, and
- Information on other important ecological factors (e.g., potential critical habitats).

Site investigations for this study were carried out on June 18, 2010 and November 17, 2011. The purpose of the investigations was to confirm the aerial interpretation. Access was limited to the road ROW for the majority of the study area and, as a result, ecological classification was limited to the Ecosite level of the Ecological Land Classification (ELC) system.

#### 3.7.1 Background

Background data were obtained from various published and non-published sources. Sources of information include:

- Guelph District Ontario Ministry of Natural Resources (MNR)
- Hamilton Conservation Authority (HCA)
- Niagara Peninsula Conservation Authority (NPCA)
- Natural Heritage Information Center (NHIC) website 2010
- City of Hamilton
- Urban Hamilton Official Plan, Schedule B, Natural Heritage System, July 2009
- Nature Counts Project, Hamilton Natural Areas Inventory, 2003.
- COSEWIC. 2009. Canadian Wildlife Species at Risk. Committee on the Status of Endangered Wildlife in Canada. Web site:  
[http://www.cosewic.gc.ca/eng/sct0/rpt/rpt\\_csar\\_e.cfm](http://www.cosewic.gc.ca/eng/sct0/rpt/rpt_csar_e.cfm) [accessed 25 Sept 2010].
- SARO List. Updated September 11, 2009.
- ELC for Southern Ontario. September, 1996.

#### 3.7.2 Field Surveys

Field surveys were conducted on June 18, 2010 and November 17, 2011. The surveys were designed to confirm the initial delineation and characterization of habitat types using aerial photography provided by the City of Hamilton, as well as the initiation of the botanical survey with spring and fall field investigations to confirm desktop analyses.

The field survey was conducted using visual inspections from the road side at each significant vegetative assemblage. Due to lack of access to lands outside the ROW, all vegetation assemblages, identified using aerial photography, were characterized to the Ecosite level using the ELC protocol. Groomed areas or parklands were designated as Manicured Grass/Trees (MGT\*).

Plant species were documented as they were encountered during the field surveys. A complete list of the vascular plant species found is presented in Appendix E. Nomenclature is based on the Ontario plant list (Newmaster et al., 2003).

### 3.8 Provincially and Locally Identified Natural Heritage Features

#### 3.8.1 Environmentally Significant Areas of Provincial Importance

##### Hamilton Escarpment ESA #47

The majority of the study area consists of developed urban areas, while roughly the southern one-third of the study area is primarily rural. The most prominent natural feature within the study area is the Hamilton Escarpment ESA, which intersects the A-Line corridor at the Claremont Access (OMNR, 2010; City of Hamilton, 2005). This significant geomorphic feature is a 90 metres high escarpment consisting of a steep to sheer slope that forms a prominent break in the Hamilton urban landscape. Natural habitats in this area are restricted to a narrow band of deciduous woodland along the steep slope of the escarpment. Due to the urban setting and numerous cross-cutting transportation and utility corridors, the vegetation communities are generally disturbed and contain many non-native species (Hamilton Conservation Authority, 2010). Nevertheless, this linear natural area serves as an ecological linkage corridor between other significant natural areas along the Niagara Escarpment. This narrow section of escarpment is also designated as Escarpment Natural Area by the Niagara Escarpment Plan (NEC, 2005).

The Hamilton Escarpment, within the study area, is designated as ESA #47 according to the Hamilton-Wentworth Official Plan (Official Plan). The ESA occupies the prominent north-facing slope forming a narrow greenbelt running for approximately 11 kilometres through the City of Hamilton. It also forms a natural separation between the intensively urbanized lower and upper sections of the City. A significant number of transportation and utility corridors cut through this feature and development of various forms encroach to the unit boundaries. It is subject to heavy pedestrian traffic in some areas, and evidence of dumping can be found in a number of locations. These pressures have left the remaining natural communities somewhat disturbed and degraded, though some significant species (e.g., Virginia Bluebells - *Mertensia virginica*) are still found in the area. In 2002, Nature Counts surveyors recorded 150 species, of which 37% were found to be introduced (Nature Counts Project, 2003). The area also functions as a significant ecological corridor to other significant natural areas along the Niagara Escarpment. It is also a good example of the Niagara Escarpment, which is a locally significant Earth Science feature.



Natural habitat within the ESA is limited to the steep slope of the Escarpment, forming a thin ribbon of broadleaf upland woods throughout its length, with pockets of tall shrub thicket, old field, and maintained grounds found in various locations. Soils are thin to absent along the rim and upper slopes of the Escarpment and the lower slopes are typically talus. Vegetation in the forested areas is typically a mixture of American elm, Manitoba maple, white ash, and black walnut. These areas vary in species dominance, and many non-native species are present. A number of mature sugar maple stands are also present. These areas have very little regeneration and the herb layer is sparse to absent.

The A-Line LRT and BRT cross the Hamilton Escarpment ESA between the Claremont Access and James Mountain Road. The exact extent of encroachment is still to be determined during future design phases. This portion of the Escarpment is mixed broadleaf woodland with some degradation evident due to foot traffic along the Bruce Trail, and the proximity of intense urbanization to the north and south.

The proposed developments will potentially impact portions of this feature adjacent to Mountain Road, in a number of areas north of the Claremont Access.



### **Twenty Mile Creek Wetland Complex**

The study area also contains the Upper Twenty Mile Creek Provincially Significant Wetland (PSW) complex. The portions of the Twenty Mile Creek watershed within the study area have a gently rolling to flat topography. This wetland complex intermittently follows Twenty Mile Creek for several kilometres along its length, the upper-most headwaters portion of which is located within and adjacent to the study area. Within the study area, the wetland can be generally characterized as small areas of riparian marsh surrounded by wet meadow and small woodlots or open woodlands. Habitat within the complex adjacent to the proposed line consists of Meadow Marsh, dominated by cattail and graminoids.

The proposed developments will potentially impact small portions of this feature adjacent to Upper James Street, in a number of areas south of Twenty Road.

### **3.8.2 Other Known Natural Heritage Features in Surrounding Area**

#### **Tiffany Creek ESA #46**

The Tiffany Creek ESA #46 is located approximately 2.5 km to the west of proposed A-Line alignment parallel with Rymal Road. The Tiffany Creek ESA is located within the eastern headwaters of Tiffany Creek, and is one of the few remaining natural areas in a highly urbanized setting. Habitat composition found within the area is diverse, with cultural meadow dominating the north-western portion, with pockets of thicket, pioneer aspen and elm woodlots, and cattail marsh found throughout. This is also found to the southwest. The remainder is a mosaic of remnant forests mainly dominated by red oak in the more mature units, with black walnut found in the lower valley slopes. Meadow marsh is prevalent in the bottom lands. A number of locally rare species are found in the area, all of which are considered secure or apparently secure by the MNR.

The proposed A-Line RT system will have no impact on this feature.

#### **Hannon Floodplain Forest ESA #63**

The Hannon Floodplain Forest is located approximately 3.7 km to the east at English Church Road. It is designated as ESA #63 on the Hamilton Environmentally Significant Areas Map (June 2005), and listed as ESAs in both the new Hamilton Official Plan and Regional Official Plan. Part of the feature, called Twenty Mile Creek Meander B, is also considered an Area of Natural and Scientific Interest (ANSI) by the MNR. The ANSI occupies most of the 20 Mile Creek floodplain between Nebo Road and Trinity Church Road. It contains a variety of representative wetland and terrestrial habitats and supports Provincially and Regionally significant species, as well as providing important ecological function as part of the 20 Mile Creek Corridor.

The proposed A-Line RT system will have no impact on this feature.

#### **Glanford Station ESA #64**

The Glanford Station Wetland is located approximately 2.5 km to the south of Airport Road. It is listed as ESA #64 on the Hamilton Environmentally Significant Areas Map (June 2005), and listed as ESAs in both the new Hamilton Official Plan and Regional Official Plan.. It is, however, considered a Class 7 wetland, occupying the headwaters of the Welland River. Habitat within the feature is somewhat disturbed, consisting of open aquatic, wet meadow, thicket with some floodplain deciduous woods. It is one of the few remaining natural areas in an intensive agricultural area and supports some significant species.

The proposed A-Line RT system will have no impact on this feature.

### 3.9 Vegetation Communities

#### 3.9.1 Regional Vegetation Communities

The study area is located within the Lake Erie Lowland Ecoregion. This is part of the Mixedwood Plain Ecozone which encompasses the lower Great Lakes basin and St. Lawrence River valley. The combination of gentle topography, fertile soils, warm growing season and abundant rainfall, have made the Mixedwood Plain Ecozone the most intensely used and populated area in Canada. Early scientists, such as Rowe (in his treatment of the Forest Regions of Canada, 1972), called this region the Deciduous Forest Region or Carolinian zone. Agriculture is the predominant land use, occupying 65% of the ecoregion.

This ecoregion extends from Windsor to Toronto, including the Niagara Peninsula at the southern tip of Ontario. The dominant land cover is cultivated land with small, often isolated areas of mixed and deciduous forests. Urban development is the other significant land cover. Sugar maple, beech, white and red oak, shagbark hickory, black walnut, and butternut, among other species, characterize climax vegetation. White elm, eastern cottonwood, balsam poplar, red and black ash, and silver maple characterize moist sites. Drier and warmer sites contain black maple, chestnut, and chinquapin oak. Tulip tree, sycamore, and bitternut hickory occur on moist slopes.

The ecoregion is underlain by carbonate-rich, Palaeozoic bedrock. Surficial deposits are dominated by a wide variety of deep glacial deposits. Southwest of the Niagara Escarpment, the land surface slopes gradually south-westward through low-relief, rolling topography. Bedrock outcrops are mainly limited to the area between Hamilton and Georgetown. Clayey Gleysolic and Gray Brown Luvisolic soils are dominant in the ecoregion.

The ecoregion has one of the warmest climates in Canada, marked by humid, warm to hot summers and mild, snowy winters. The mean annual temperature is approximately 8°C. It reaches as high as 9°C in the Windsor area. The mean summer temperature is 18°C and the mean winter temperature is -2.5°C. The mean annual precipitation ranges from 750 to 900 mm. Precipitation is evenly distributed throughout the year.

#### 3.9.2 Local Vegetation Communities

The Study area is limited to the lands immediately adjacent, east and west, to James Street North from Guise Street E. south to the John C. Munro Hamilton International Airport, including Upper James Street, Homestead Drive, and Airport Road West. The majority of these areas are intensely urbanized and most of the vegetated landscapes have been created to provide park settings, or landscaped property holdings, which are subject to constant maintenance. Agriculture and rural residential development is more prevalent to the south. Those natural areas remaining, mainly found to the south, have been subject to significant anthropomorphic pressure, which has degraded the natural character of those vegetative assemblies that remain. Cultural meadow or groomed open spaces dominate the southern portion of the study area, along with some small remnant woodlots, thickets and wetland pockets associated with Twenty Mile Creek and its tributaries. Soils within the study area are generally sand with localized gravel; deposited as sheet sands, lags, and beaches to the north of the Escarpment, trending to thick and continuous till to the south. In the vicinity of Twenty Mile Road, this changes to silt, and clay, locally containing stones; which have been deposited as quiet water sediments.

#### 3.9.3 Ecological Land Classification Mapping

As stated above, lack of access outside the ROW limited the level of detail obtainable during the field visits. As a result, vegetation units were mapped and characterized to the Ecosite level using the ELC protocol. A description of these can be found below, and mapping is provided in Figures 3.2 to 3.10 following this section.



Figure 3.2: Terrestrial Environment Ecological Land Classification (ELC)

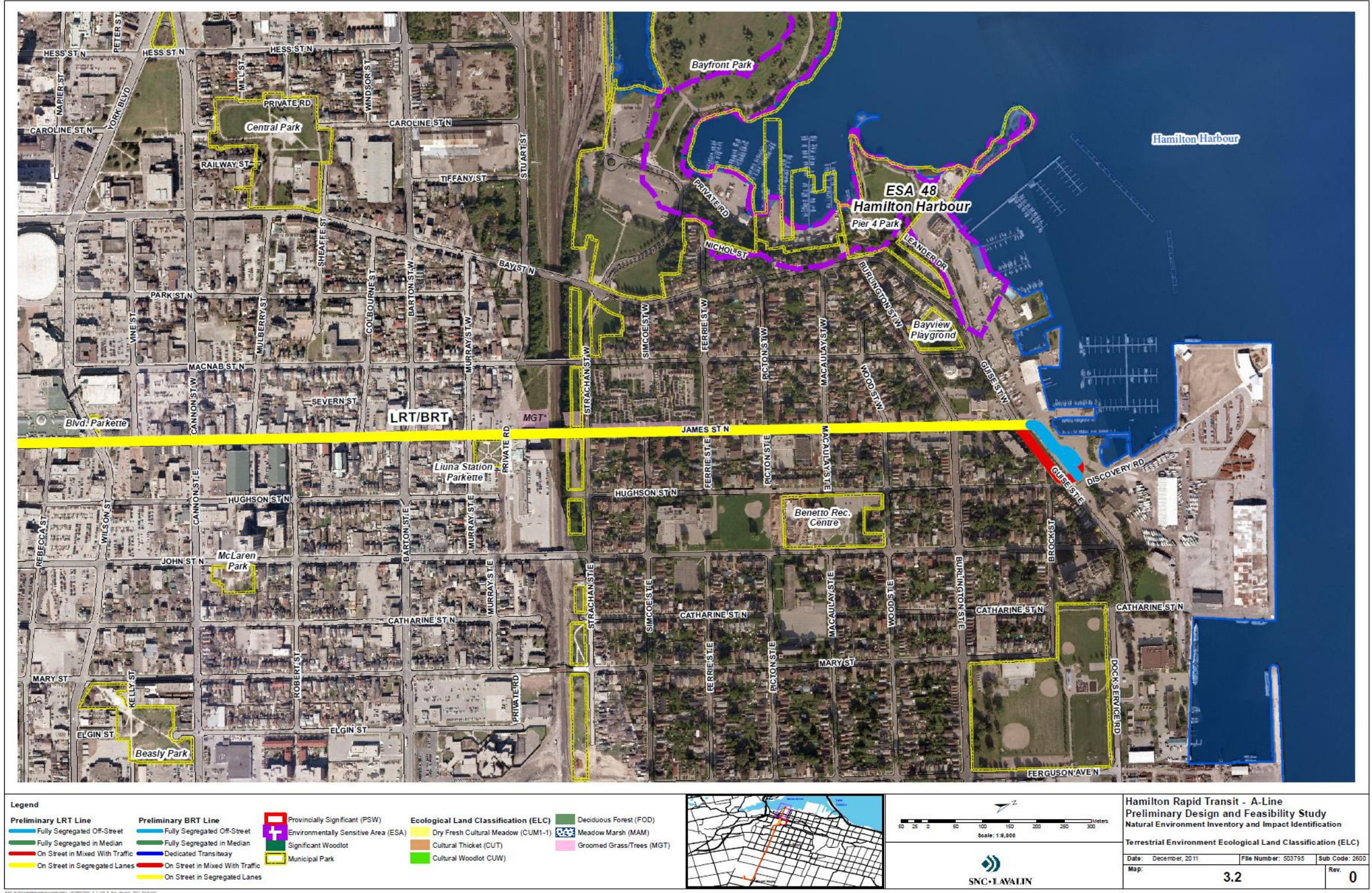




Figure 3.3: Terrestrial Environment Ecological Land Classification (ELC)

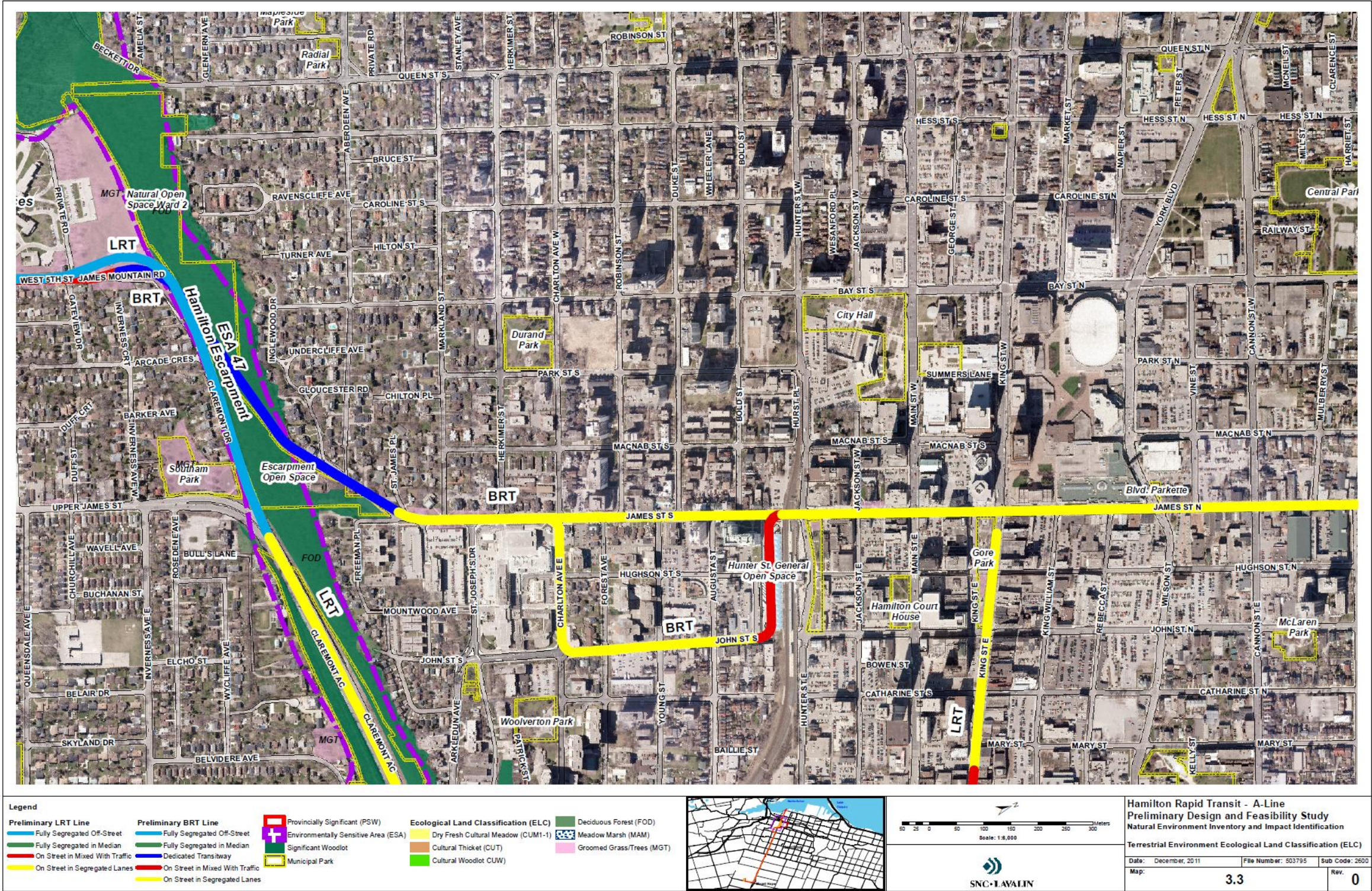




Figure 3.4: Terrestrial Environment Ecological Land Classification (ELC)

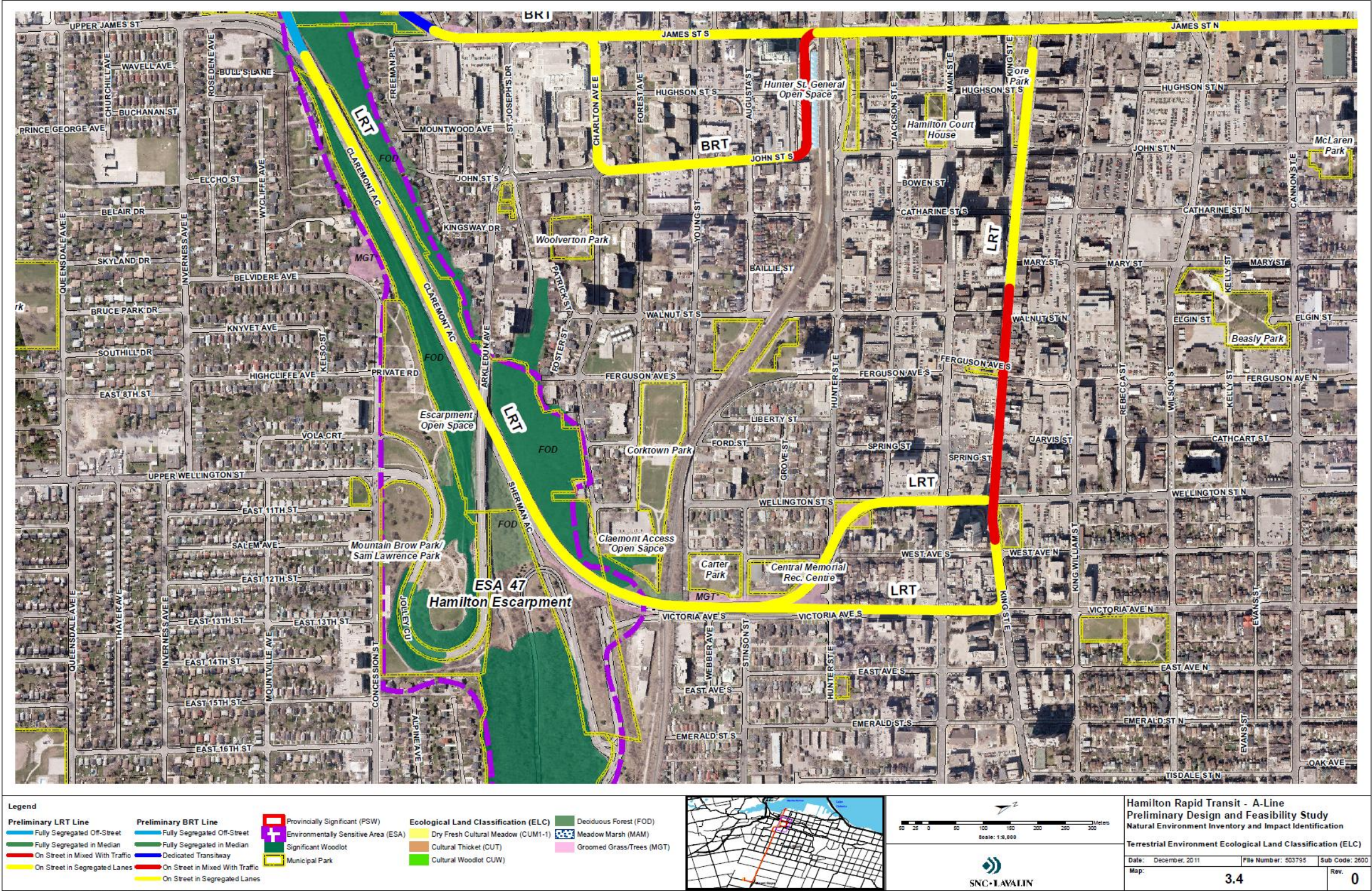




Figure 3.5: Terrestrial Environment Ecological Land Classification (ELC)

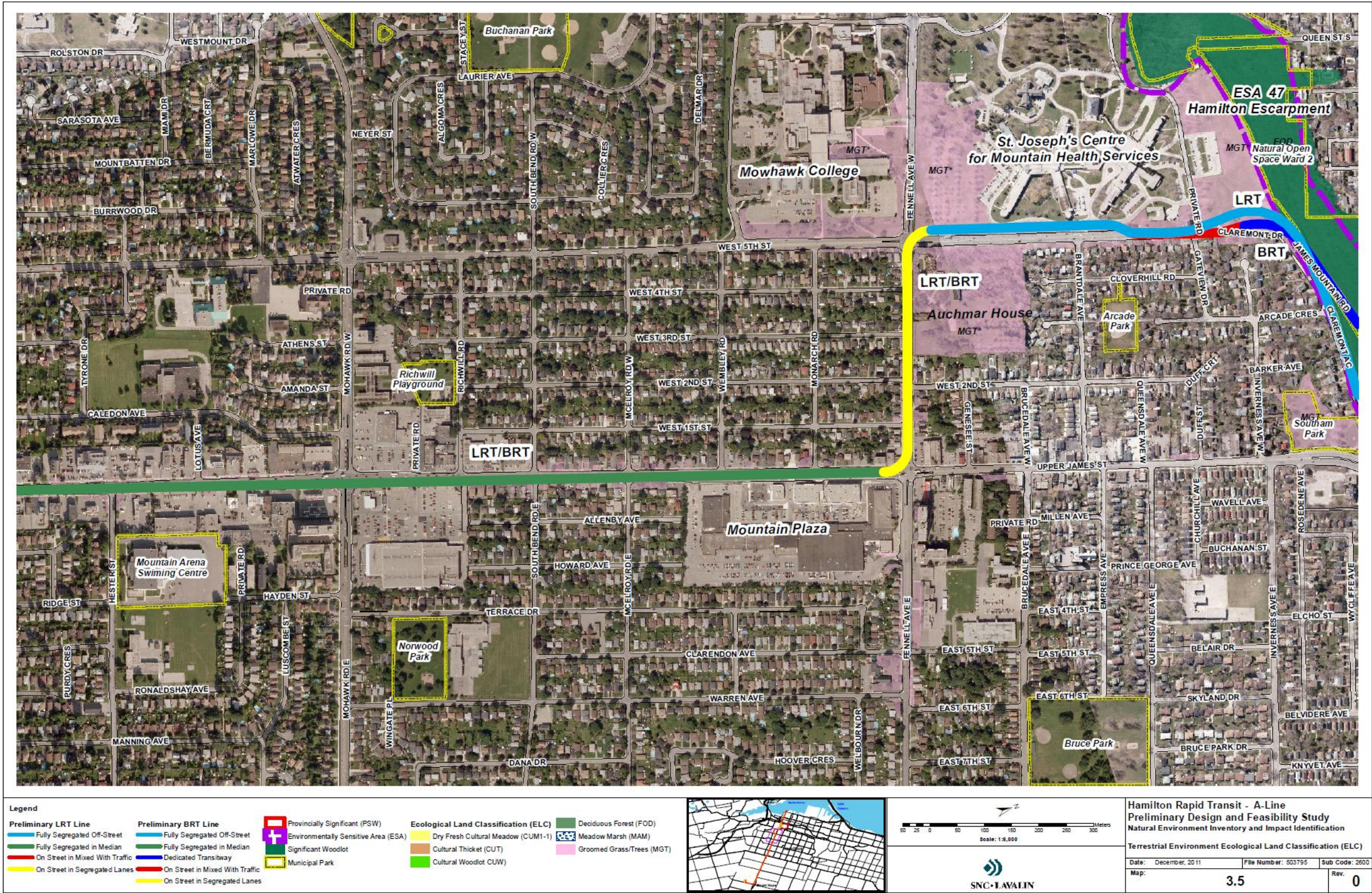




Figure 3.6: Terrestrial Environment Ecological Land Classification (ELC)

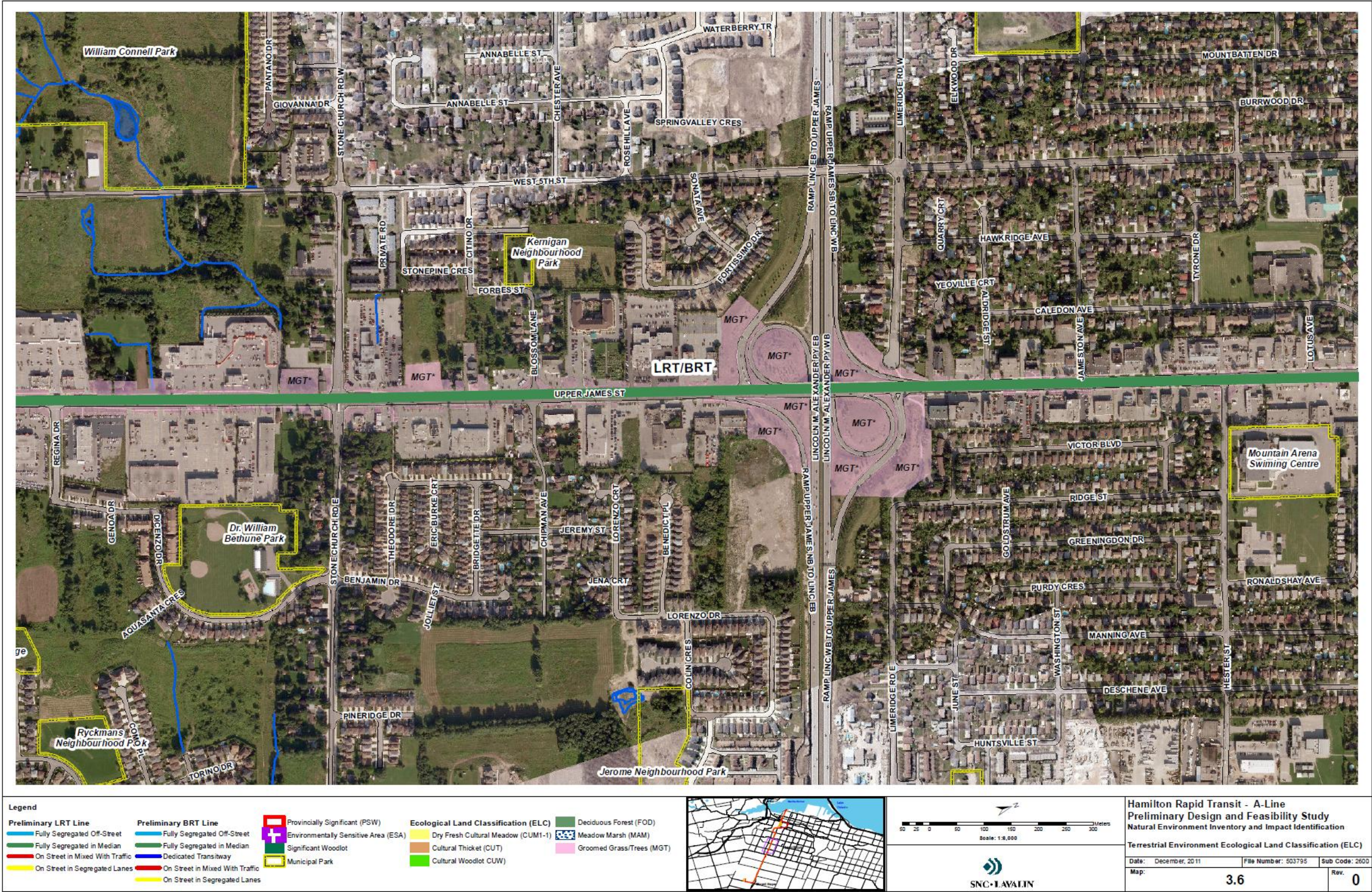




Figure 3.7: Terrestrial Environment Ecological Land Classification (ELC)

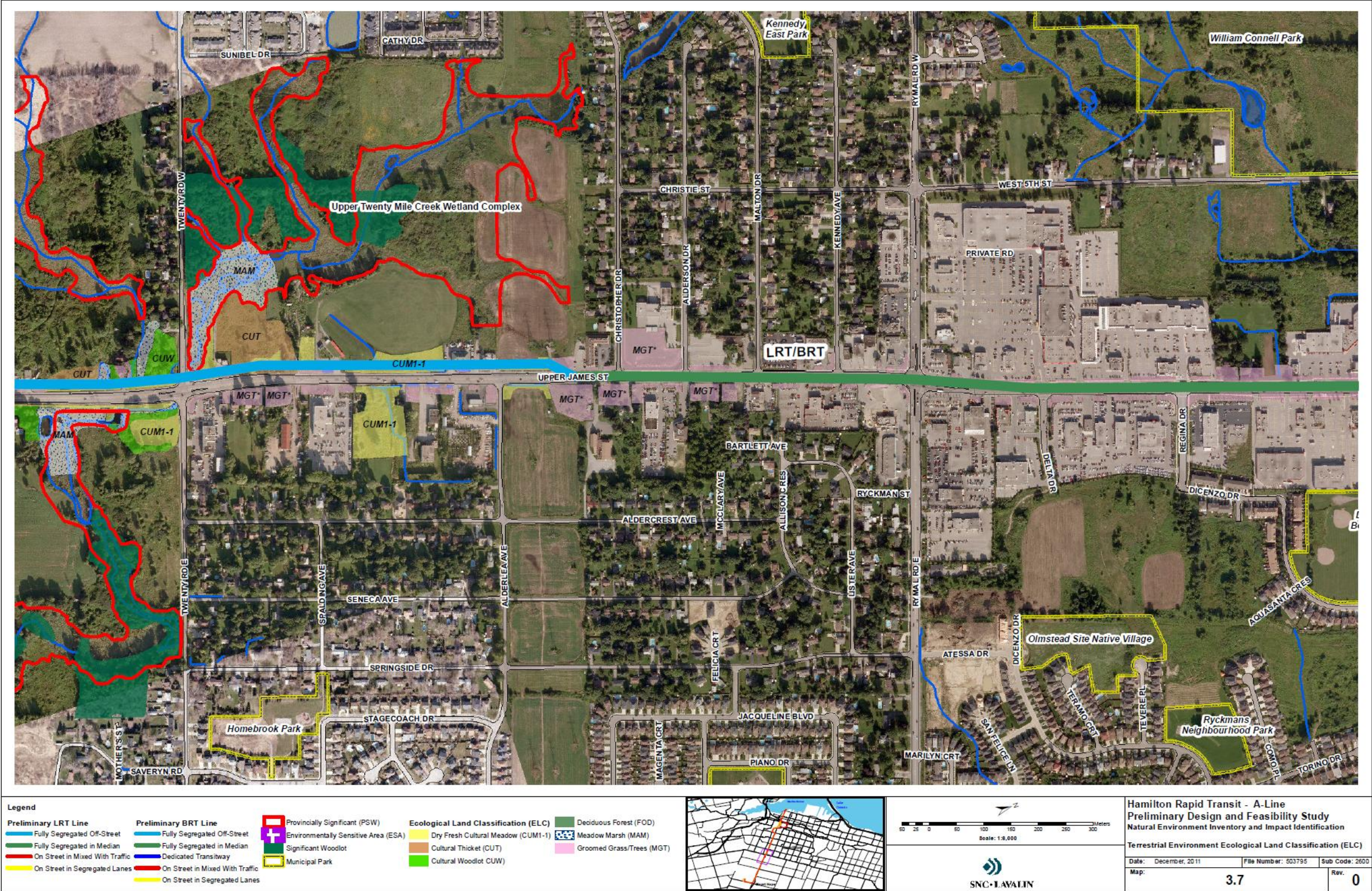




Figure 3.8: Terrestrial Environment Ecological Land Classification (ELC)

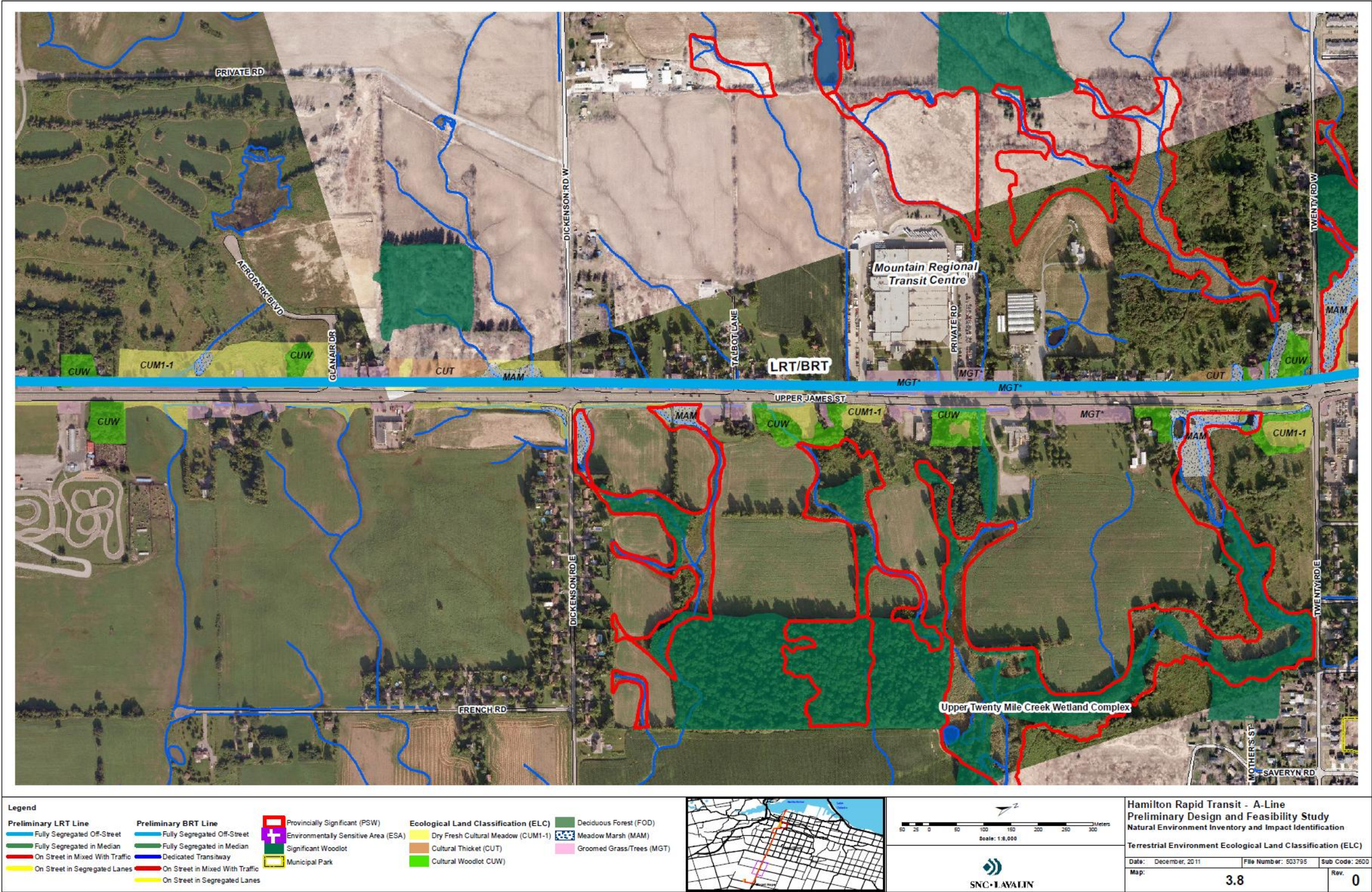




Figure 3.9: Terrestrial Environment Ecological Land Classification (ELC)

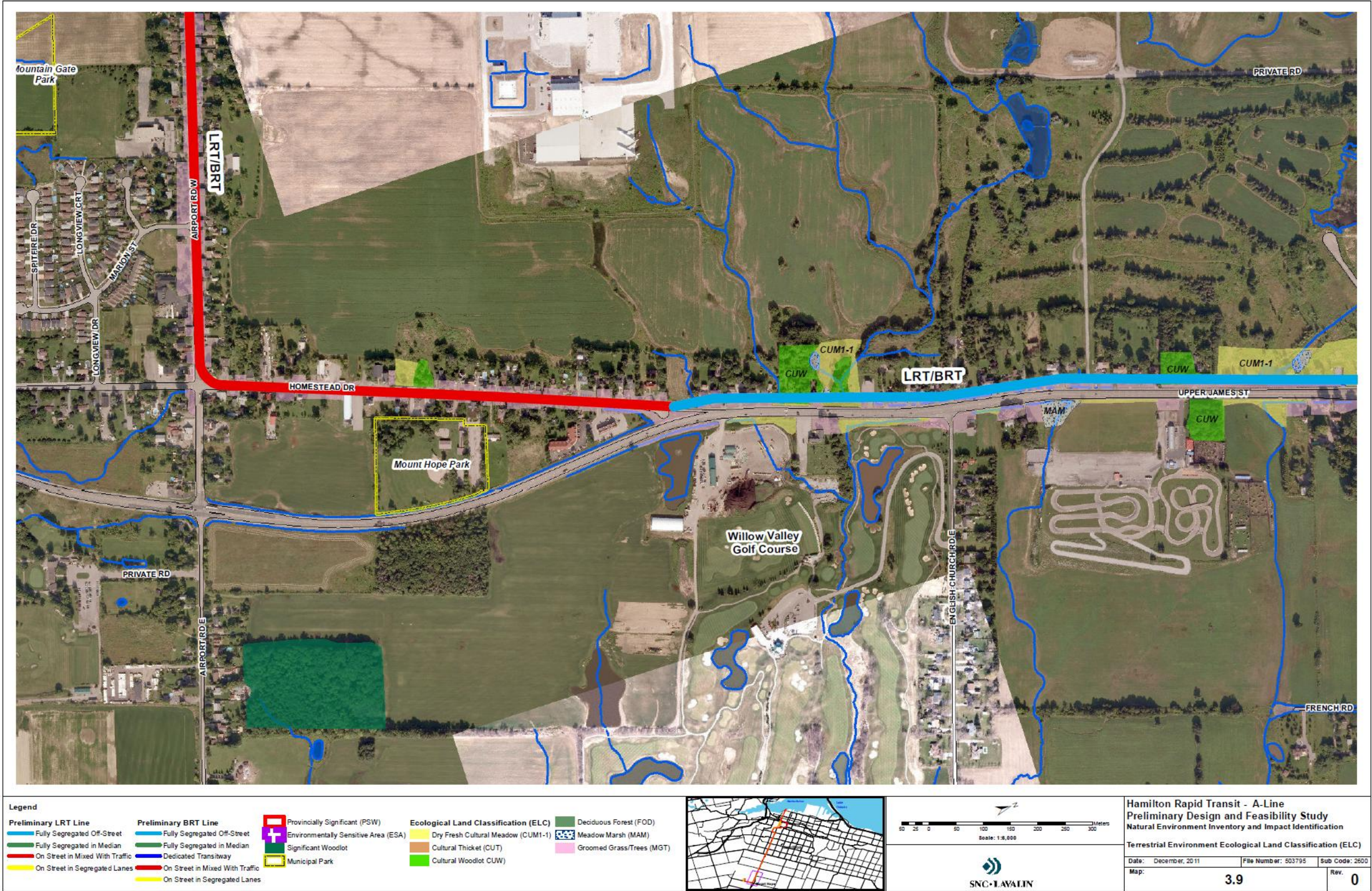
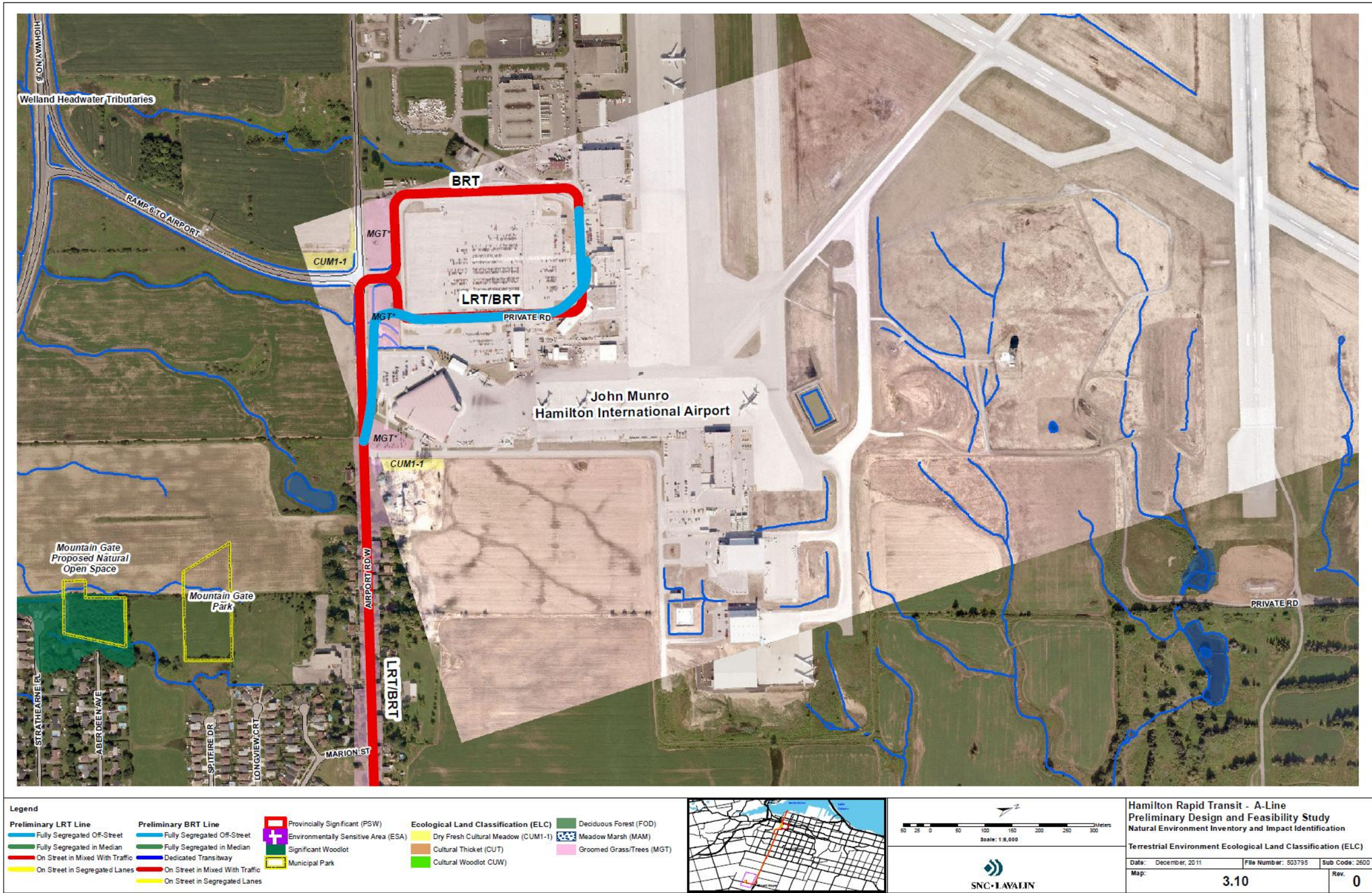




Figure 3.10: Terrestrial Environment Ecological Land Classification (ELC)





### **Manicured Grass/Trees (MGT)**



The majority of the habitat found within the study area on either side of James Street N., James Street S., James Mountain Road, Upper James Street, Homestead Drive, and Airport Road is best described as Manicured Grass/Trees. This vegetation type is associated with the residential and commercial properties within the City



and the rural residential properties towards the Airport. Typical tree species observed in these areas include white spruce (*Picea glauca*), Norway spruce (*Picea abies*), Austrian pine (*Pinus nigra*), Norway maple (*Acer platanoides*), sugar maple (*Acer saccharum*), black locust (*Juglans nigra*), white birch (*Betula papyrifera*), and white ash (*Fraxinus americana*).

### **Cultural Meadow (CUM1-1)**

The second most common habitat type is Dry Moist Cultural Meadow, which is dominated by grasses, along with sun tolerant broad-leaf vegetation typical of old fields and disturbed areas. This vegetation type dominates the road ROW, and historic farm fields found in various locations. Herbaceous vegetation in the cultural meadow areas consists of old field type vegetation, such as introduced forage grasses (e.g., smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), reed canary grass (*Phalaris arundinacea*), red fescue (*Festuca rubra*) and Kentucky blue grass (*Poa pratensis*)). Broad-leaved ground cover includes common milkweed (*Asclepias syriaca*), common mullien (*Verbascum thapsus*), common burdock (*Arctium minus*), daisy fleabane (*Erigeron annuus*), wild carrot (*Daucus carota*), rough cinquefoil (*Potentilla norvegica*), garlic mustard (*Alliaria petiolata*), white sweet clover (*Melilotus alba*), bittersweet nightshade (*Solanum dulcamara*), crown vetch (*Coronilla varia*), common St. John's wort (*Hypericum perforatum*), common ragweed (*Ambrosia artemisiifolia*), yarrow (*Achillea millefolium*), bull thistle (*Cirsium vulgare*), teasel (*Dipsacus fullonum*), alsike clover (*Trifolium hybridum* ssp. *Elegans*) as well as perennial asters (*Aster* sp) and goldenrods (*Solidago* sp).

There are also a number of hedgerow and naturalized/planted isolated and clustered trees and shrubs of various ages within these areas. These include tree species such as Eastern white pine (*Pinus strobus*), white spruce, Norway spruce, Austrian pine, Norway maple, Manitoba maple (*Acer negundo*), sugar maple, black locust, white ash, American elm (*Ulmus americana*), white birch, and balsam poplar (*Populus balsamifera*), along with shrubs, such as staghorn sumac (*Rhus typhina*), common buckthorn (*Rhamnus cathartica*), tartarian honeysuckle (*Lonicera tatarica*), red raspberry (*Rubus idaeus*), and grey dogwood (*Cornus foemina*), with red osier dogwood (*Cornus stolonifera*), and slender willow (*Salix petiolaris*) found in the wetter areas.

### **Deciduous Forest (FOD)**

One pocket of deciduous forest was observed within the study area in the area where the alignment crosses the Niagara Escarpment ESA. The Escarpment in this area is occupied by a linear band of forest which varies in width depending on the development which has occurred to the north and south.



In the vicinity of Mountain Road, this is an upland forest situated on very steep slopes dominated by sugar maple along with abundant Norway maple, and black walnut (*Juglans nigra*). American elm, black cherry (*Prunus serotina*), black locust (*Robinia pseudo-acacia*), Freeman's maple (*Acer freemanii*), and Manitoba maple are also present. Moving east along the Claremont Access, black locust and Norway maple become dominant and the slope eases off slightly. The construction of the Claremont Access has resulted in alterations to the slope in some areas and regeneration is well developed with young locust and maple with pockets of cultural meadow.

The sub-canopy and understory vegetation is sparse within the very steep sections, becoming more abundant in areas where the slopes are less severe or some disturbance has taken place. This is particularly evident adjacent to the Claremont Access in areas where road construction has altered the historic slope. Sub-canopy species observed include sugar maple, black locust and Norway maple saplings, as well as common buckthorn, and choke cherry (*Prunus virginiana*). The understory consisted of tartarian honeysuckle, red-berried elderberry (*Sambucus racemosa*), red raspberry (*Rubus idaeus*), staghorn sumac, riverbank grape (*Vitis riparia*), and poison ivy (*Rhus radicans*). Herbaceous vegetation follows a similar pattern, with rough avens (*Geum laciniatum*), large leaved aster (*Aster macrophyllus*), common buttercup (*Ranunculus acris*), garlic mustard (*Alliaria petiolata*), and celandine (*Chelidonium majus*) found scattered within the steeper interior areas and vegetation similar to the cultural meadow areas observed along the roadside edges and disturbed areas observed periodically moving east along the Claremont Access.

### **Cultural Woodlot (CUW)**

A number of cultural woodlots were observed to the south of Twenty Road where the land use becomes more rural residential (refer to Figures 3.7 to 3.9). The majority of these within the study area are remnant lowland forest areas associated with drainage systems that were left during agricultural development, upland areas retained for firewood, or historic farmsteads that have naturalized. Trees observed in the upland portions include sugar maple, Norway maple, Manitoba maple, red oak (*Quercus rubra*), balsam poplar (*Populus balsamifera*), black walnut, black locust, white cedar (*Thuja occidentalis*), white pine (*Pinus strobus*), and Norway spruce. The wooded lowland areas are typically dominated by crack willow (*Salix fragilis*), or white willow (*Salix alba*), with Manitoba maple and American elm present. These woodlots are quite small and the sub-canopy and understory can vary significantly, depending the size of the unit and the amount of periodic disturbance occurring. Sub-canopy species include common buckthorn, hawthorn (*Crataegus* sp) and tree species saplings, and the understory a combination of tartarian honeysuckle, grey dogwood (*Cornus foemina* ssp. *racemosa*), red currant (*Ribes rubrum*), red raspberry, and Virginia creeper (*Parthenocissus quinquefolia*), with red osier dogwood observed in the wetter areas. Herbaceous vegetation was typically dominated by garlic mustard (*Alliaria petiolata*), bittersweet nightshade (*Solanum dulcamara*), and yellow avens (*Geum aleppicum*), with cultural meadow species found in edge and open areas.

### **Cultural Thicket (CUT)**

A number of Cultural Thickets were also observed at and to the south of Twenty Road where the land use becomes more rural residential (refer to Figure 3.6 to 3.9). These areas are typically naturalized farm fields or grazing areas. Cover varies within these areas, but most contain a mixture of dense cover interspersed with small open cultural meadow inclusions. Grazing was observed in the unit to the northwest of the Upper James Street/Twenty Road intersection. Canopy vegetation observed consists of hawthorn, common buckthorn, tartarian honeysuckle, grey dogwood, red osier dogwood, choke cherry, and some scattered balsam poplar, Manitoba maple, and crack willow. Ground cover was typical of the cultural meadow areas described above.



### **Meadow Marsh (MAM)**



The only wetlands found within the study area are Meadow Marsh types located along the east and west sides of Upper James Street from Twenty Road to the south. A number of these in the vicinity of Twenty Road are associated with the headwater tributaries and form part of the Upper Twenty Mile Creek Wetland Complex PSW. The majority of those found further south are small pockets associated with other vegetation types (refer to 3.7 to 3.9). Most of these areas are dominated by common cattail (*Typha latifolia*), though a few are dominated by reed canary grass (*Phalaris arundinacea*) or common reed grass (*Phragmites australis*).

Shrub cover varies, with some dense inclusions and scattered individuals of red osier dogwood, slender



willow, and bebb's willow (*Salix bebbiana*). Isolated crack willow, and white willow were also found. Herbs, such as beggar's ticks (*Bidens* sp), spotted joe pye-weed (*Eupatorium maculatum* ssp. *maculatum*), lady's thumb (*Polygonum persicaria*), New England aster (*Aster novae-angliae*), rough goldenrod (*Solidago rugosa*) and tall goldenrod (*Solidago altissima*), were also observed, as well as redtop grass (*Agrostis gigantea*) and Bebb's sedge (*Carex bebbii*).

### 3.10 Vascular Plants

A complete species list of vascular plants observed and noted within the study area can be found in Appendix E. The list is organized by scientific family name, genus and species, and nomenclature is based on the Ontario plant list (Newmaster et al. 2003). Given the limited nature of access to the site, the species list generated as part of the field program is somewhat limited. A total of 99 vascular plant species were observed. Of these, 50 (50%) are listed as native species, and 49 (50%) are listed as invasive. Of the species observed, the majority are listed as S5 or SE5 by the OMNR, with a few S4 or S4? (black walnut, rough avens, calico aster and Virginia creeper). No species listed as Threatened by COSEWIC or COSSARO were observed within the study area.

The majority of the species observed are typical of disturbed environments, or have been planted as part of landscaping initiatives, and as such, provide no real indication of the true floristic quality of the sites. The disturbed and fragmented nature of the areas studied is apparent in the small size of the vegetative communities found and the even distribution of native and non-native species observed within the majority of these units.

It should be noted that the species list is not a complete list of the plants of the area. This is particularly applicable to short-term seasonal plants since the area was not observed throughout the growing season. Nomenclature is primarily in accordance with the Ontario Plant List (Newmaster, 1998), and secondarily with NHIC (2010).

#### 3.10.1 Plant Species at Risk

A review of all background information available from the NHIC Biodiversity Explorer database identified thirty-three significant plant species known from the vicinity of the study area (OMNR 2010). The names of these significant species, and their significance ranks are outlined below in Table 3.3.

**Table 3.3: Significant Vegetation Species Known from the Vicinity of the Study Area**

Common Name	Scientific Name	S-Rank <sup>1</sup>	COSEWIC status <sup>2</sup>	SARO status <sup>3</sup>
<b>Black Cohosh</b>	<i>Actaea racemosa</i>	S2		
<b>Puttyroot</b>	<i>Aplectrum hyemale</i>	S2		
<b>Downy Yellow False Foxglove</b>	<i>Aureolaria pedicularia</i>	S1		
<b>White-tinged Sedge</b>	<i>Carex albicans</i> var. <i>albicans</i>	S3		
<b>Pignut Hickory</b>	<i>Carya glabra</i>	S3		
<b>American Chestnut</b>	<i>Castanea dentata</i>	S2	END	END
<b>Spotted Wintergreen</b>	<i>Chimaphila maculata</i>	S1	END	END
<b>Brainerd's Hawthorn</b>	<i>Crataegus brainerdii</i>	S2		
<b>Northern Hawthorn</b>	<i>Crataegus dissona</i>	S3		
<b>Forked Panic Grass</b>	<i>Dichanthelium dichotomum</i>	S2		
<b>Burning Bush</b>	<i>Euonymus atropurpureus</i>	S3		
<b>White Wood Aster</b>	<i>Eurybia divaricata</i>	S2	THR	THR
<b>Panicled Hawkweed</b>	<i>Hieracium paniculatum</i>	S2		

Common Name	Scientific Name	S-Rank <sup>1</sup>	COSEWIC status <sup>2</sup>	SARO status <sup>3</sup>
Yellow Stargrass	<i>Hypoxis hirsute</i>	S3		
Narrow-leaved Puccoon	<i>Lithospermum incisum</i>	S1		
Virginia Lungwort	<i>Mertensia virginica</i>	S3		
Scarlet Beebalm	<i>Monarda didyma</i>	S3		
Large Yellow Pond-lily	<i>Nuphar advena</i>	S3		
Soft-hairy False Gromwell	<i>Onosmodium molle</i> ssp. <i>hispidissimum</i>	S2		
Woodland Pinedrops	<i>Pterospora andromedea</i>	S2		
Shiny Wedge Grass	<i>Sphenopholis nitida</i>	S1		
Clinton's Clubrush	<i>Trichophorum clintonii</i>	S2S3		
Perfoliate Bellwort	<i>Uvularia perfoliata</i>	S1		
Carolina Vetch	<i>Vicia caroliniana</i>	S2		

<sup>1</sup>OMNR 2010; <sup>2</sup>COSEWIC 2009; <sup>3</sup>OMNR 2009; <sup>4</sup>OMNR 2000.

S1- Critically Imperilled, S2- Imperilled, S3- Vulnerable, S4- Apparently Secure

NAR- Not at Risk, THR- Threatened, SC- Special Concern, END - Endangered

Table 3.3 lists all significant species (S1-S3, Species at Risk) that have historically been documented by NHIC within the vicinity of the study area. All of these plant species generally require a wide range of high quality forest or wetland habitats, most of which are not currently present in the study area. Only the south (rural) end of the study area may provide habitats for significant species. Specifically, these would constitute wetland, field/meadow and open woodland features within the footprint of the proposed off-street component along Upper James Street. Of significant species recorded within the past 30 years, only two species, Brainerd's hawthorn (*Crataegus brainerdii*; S2 – provincially imperilled) and northern hawthorn (*Crataegus dissona*; S3 – provincially vulnerable), may potentially occur within the corridor footprint, specifically within old fields, pastures or open woodlands. Virginia Bluebell (*Mertensia virginica*), listed as locally rare (S3), are known to occur within ESA #47 (Hamilton Escarpment), which is crossed by the proposed line. None of the species listed above were observed during the field visits (Nature Counts Project, 2003). Prior to clearing/grubbing for construction of the off-street A-Line corridor, a multi-season survey for these species, identifying features such as flowers and fruits, will be required to identify its presence within and adjacent to the corridor footprint. If deemed necessary, all individuals of these species encountered within the corridor should be transplanted to a nearby area of equal or greater habitat quality, under the direction of a qualified botanist. All relocations will be approved by the Ontario Ministry of Natural Resources (MNR) under the Endangered Species Act (2007).

### **Impact Assessment and Mitigation**

Impacts of proposed the Hamilton A-line RT system construction will be limited to the existing road bed or ROW of the associated roadways over the majority of the line.

### **Potential Impacts:**

The potential impacts of the proposed development have been organized by sections of the route described below. At this point in the design, it is not possible to quantify areas of potential removal with any accuracy since the design level of detail normally used for environmental assessment purpose has not yet been developed. As such, the list below only indicates which vegetation types may be affected within each section.

Within the northern portion of the study area, Guise Street East to Twenty Road, the proposed A-Line LRT and BRT lines run through areas that are predominantly urban for the majority of their length. Within these areas, there is a potential to impact manicured grass and trees associated with residential, commercial and institutional properties. The alignments are also adjacent to a number of municipal parks and open spaces that may be affected. These are, from north to south:

- Designated open space at Strachan Street West; Boulevard Parkette, and Liuna Station Parkette on James Street N.;
- Gore Park, on King Street E.;
- Hunter Street General Open Space, at Hunter Street, and Wellington Street S.;
- Central memorial Recreation Centre and Carter Park along the start of the Claremont Access;
- Claremont Access and Escarpment Open Space, which bounds the Claremont Access, and James Mountain Road;
- Southam Park on Upper James Street; and,
- Mount Hope Park near Mount Hope at the south end of the study area.

The Hamilton Escarpment ESA is intersected by the proposed A-Line Light Rail Transit corridor at the Claremont Access. The A-Line corridor through the ESA will occur within the existing footprint of the ROW. Although the component of the A-Line corridor that follows the Claremont Access ramp to West 5<sup>th</sup> Street is considered to be fully-segregated off-street in the associated illustrative route mapping (Appendix A, Figure 1), in actuality the corridor will occur within the existing infrastructure of the ramp. The ramp component will be closed off to all vehicular traffic other than for LRT, removing its designation as a formal “street”, and thus is considered to be “off-street” in illustrative mapping. Since the proposed development will occur entirely within existing ROW infrastructure, no direct impacts to the Hamilton Escarpment ESA are anticipated.

The BRT A-Line route is to intersect the Hamilton Escarpment ESA at James Mountain Road. However, because the proposed route occurs entirely within the existing road allowance, no direct impacts on the ESA are anticipated.

The Claremont Access and Escarpment Open Space is also designated as an ESA and Significant Woodlot, and has the potential to contain sensitive features.

From just north of Twenty Road, agricultural and rural residential uses become prevalent along Upper James Street. The majority of the vegetation in these areas consists of Manicured Grass and Trees associated with the rural residential properties, along with Cultural Meadow within the road ROW and fallow fields. Small sections of Cultural Thicket, and Cultural Woodlot are also found in a number of locations. There are also a number of pockets of Meadow Marsh. The majority of these are associated with the headwaters of Twenty Mile Creek, and a significant number of them are designated as PSW. Most of these features are on the east side of Upper James Street, but a few are adjacent to the proposed alignment, and may be impacted by the construction.

On the 1.4 km stretch of Airport Road, from Homestead Drive, through Mount Hope, to the Airport terminus of the proposed alignment, the majority of vegetation consists of Manicured Grass and Trees. There is one small section of Cultural Meadow, adjacent to the airport properties that may be affected by the A-Line LRT and BRT construction.

In summary, the areas of vegetation along the A-Line LRT and BRT that may potentially be impacted include:

- Waterfront and James St North (A-Line LRT and BRT)
  - Adjacent to:
    - Manicured grass and trees (MGT\*)
    - Municipal Park/Open Space
- James Mountain Road (A-Line BRT)
  - Adjacent to:
    - Deciduous Forest (FOD)
    - Niagara Escarpment (ESA and Significant Woodlot)

- Manicured grass and trees (MGT\*)
- King Street West, from James Street North to Victoria Avenue, Victoria Avenue, Wellington Street, and the Claremont Access (A-Line LRT)
  - Adjacent to:
    - Manicured grass and trees (MGT\*)
    - Cultural meadow (CUM)Deciduous forest
    - Cultural thicket (CUT)
    - Deciduous Forest (FOD)
    - Niagara Escarpment (ESA and Significant Woodlot)
    - Municipal Park/Open Space
- Upper James St, north of the Lincoln M. Alexander parkway (A-Line LRT and BRT)
  - Adjacent to:
    - Manicured grass and trees (MGT\*)
- Upper James St, south of the Lincoln M. Alexander parkway between Stone Church Road and Rymal Road (A-Line LRT and BRT)
  - Adjacent to:
    - Manicured grass and trees (MGT\*)
- Upper James St, between Rymal Road and Twenty Road East (A-Line LRT and BRT)
  - Adjacent to:
    - Manicured grass and trees (MGT\*)
    - Cultural meadow (CUM)
    - Cultural thicket (CUT)
    - Cultural Woodlot (CUW)
    - Meadow Marsh (MAM) (PSW)
- Upper James St, south from Twenty Road East to Dickenson Road
  - Adjacent to:
    - Manicured grass and trees
    - (MGT\*) Cultural meadow (CUM)
    - Cultural woodlot (CUW)
    - Meadow Marsh (MAM)
    - Meadow Marsh (PSW)
- Upper James St, south from Dickenson Road to English Church Road East:
  - Adjacent to:
    - Manicured grass and trees (MGT\*)
    - Cultural meadow (CUM)
    - Cultural Woodlot (CUW)
    - Meadow Marsh (MAM) (PSW)
    - Meadow Marsh (MAM) (PSW)
- Upper James St, English Church Road/Homestead Drive to Airport Road
  - Adjacent to:
    - Manicured grass and trees (MGT\*)
    - Cultural meadow (CUM)
    - Cultural Woodlot (CUW)

- Meadow Marsh (MAM)
  - Municipal Park/Open Space
- Airport Road West to John C. Munro Hamilton International Airport
  - Adjacent to:
    - Manicured grass and trees (MGT\*)
    - Cultural meadow (CUM)

### 3.11 Mitigation

The following Mitigation measure should be implemented to minimize the effects of construction of the A-Line Rapid Transit system on those natural and/or semi-natural vegetative assemblies found within the project area.

- Minimize encroachment on, or avoid remnant woodlots and large healthy trees where possible. Individual specimens to be saved will be marked on the ground before construction takes place;
- Trees and areas to be preserved within and adjacent to the ROW will be identified in a Tree Protection Plan and protected with snow fence defining Tree Protection Zone(s);
- Inclusion of hard and soft landscaping in the corridor, including planting of additional street trees, where opportunities present themselves;
- Approval will be obtained, and compensation/reimbursement will be provided, as required, for displacement of publicly owned roadside trees on public property, in compliance with City of Hamilton's Public Tree Removal Policy, the Forest Management Plan (Reforestation Policy) and By-Law 06-151 (Public Trees By-Law), as amended.
- For design and implementation of works in the Red Hill Creek watershed, the City will work collaboratively with the Red Hill Valley Stewardship Board to develop Environmental and Ecological Principles, which will initially be prepared and provided to the RT Team by the Board.
- Designated staging and construction vehicle maintenance/refueling areas will be identified and enforced;
- Siltation control in areas where sedimentation could potentially affect vegetation not scheduled for removal;
- Stormwater management to maximize runoff water quality, and provide some peak flow controls, which will benefit nearby natural features;
- The movement of construction machinery will be limited to within the boundaries of the RT ROW and operated in a manner that minimizes damage to adjacent vegetation;
- Roots and branches, if damaged, will be treated using approved horticultural methods;
- Tree management, as needed, to remove any potentially hazardous trees along new wooded edges, and maintain forest health and balance;
- Trees felled will be dropped to fall within the RT ROW to avoid damage to the remaining vegetation, where practicable;
- Retain dead standing trees where possible as long as there is no safety hazard;
- Wherever possible, construction activities will be restricted within the dripline of all trees not scheduled for removal;
- No rare or endangered species have been identified within the study area. Specimens of rare or otherwise significant species, if observed, would be transplanted in nearby compatible habitat, where



practical. The survival rate of any relocated rare and endangered species would also be monitored periodically.

- Where practicable, use only native species for landscaping efforts along the RT ROW;
- Provide dense edge plantings in areas of fresh forest edge exposure to protect from drying winds, sun exposure (desiccation and spread of invasive sun-tolerant plant species), and salt spray. These plantings may constitute an exception to the native species mandate, since non-native conifers may provide better screening/protection than native options.
- Return ROW to pre-construction or better condition, where possible.

## 4.0 HYDROGEOLOGY

### 4.1 Introduction

The purposes of the hydrogeological section of this report are to:

- Provide a detailed hydrogeological description for the proposed A-Line route;
- Identify areas of potential concern;
- Evaluate the potential impact of the construction activities along the A-line corridor on the groundwater regime; and
- Recommend mitigation measures to address the potential impacts.

For these purposes, available information pertaining to the local geology, hydrogeology and infrastructure were reviewed, in conjunction with the proposed construction methods.

### 4.2 Physical setting

The majority of the study area is heavily urbanized, with significant building structures along the A-Line corridor. A small section in the south is agricultural. Generally, few natural areas occur along the proposed A-Line corridor. As alluded to in previous sections of this report, natural features of note that do occur include the Niagara Escarpment and those associated with the headwaters of the Spencer Creek, Red Hill Creek, Twenty Mile Creek and the Upper Welland River watersheds. A study of groundwater resources in the City of Hamilton area was conducted by SNC-Lavalin Engineers and Constructors Inc. in association with Charlesworth & Associates (SLE&C, 2006). The following information is extracted from this study.

#### 4.2.1 Topography

Ground surface along the proposed A-Line corridor ranges from 75 to 100 m above mean sea level (amsl) to the north of the Escarpment and 190 to 240 m amsl south of the Escarpment. The Escarpment results in a change in elevation of approximately 70 to 90 m, with near vertical cliffs. Below the Escarpment, the topography slopes gently northward towards Lake Ontario. South of the Escarpment, the topography slopes eastward towards Red Hill Creek or Twenty Mile Creek in the vicinity of the Hamilton Airport area.

#### 4.2.2 Physiography

The proposed A-Line corridor runs southwards across the Iroquois Plain, the Niagara Escarpment and the Haldimand Clay Plain (Chapman and Putnam, 1996). Each area has been significantly influenced by Quaternary or Pleistocene glaciation approximately 10,000 to 12,000 years ago.

The most prominent landform within the City of Hamilton is the Niagara Escarpment, a bedrock escarpment characterized by steep cliffs on the eastern side and gently sloping terrain to the west. The configuration of the Escarpment is greatly influenced by the Dundas Valley, which is pre-glacial in origin and extends inland for about 13 kilometres from the western end of Lake Ontario. It contains a major buried valley.

The Iroquois Plain is located between the foot of the Niagara Escarpment and Lake Ontario and resulted from flooding of the area during the Pleistocene by glacial Lake Iroquois. The plain consists of lake deposits and lake-bottom sediments that have been smoothed by wave action. The width of this plain varies from a few hundred meters to 13 km, but is usually on the order of 3 km wide within the City of Hamilton. This is the youngest large lake plain within the City of Hamilton and also occurs at the lowest elevation. Between Lake Ontario and the Niagara Escarpment, the plain is dissected by a number of creeks, with lagoons or marshes often found at their outlet to the Lake.

The Haldimand Clay Plain extends from the Niagara Escarpment south to Lake Erie. A glacial lake also covered this area and, as a result, at some locations, stratified clay overlies glacial clay till and there are also intermixed layers of till and stratified clay. The thickness of these deposits increases southward from the

Escarpment. The Horseshoe Moraines, including the Galt Moraine, constitute a long system of glacial deposits that skirt the western edge of the City of Hamilton. The deposits here are comprised of mixed till, kame, and sand and gravel terrace. Some of the moraine is very hilly with significant local relief.

#### 4.2.3 Geology

The geological setting of the City of Hamilton forms the framework for hydrogeological conditions. The geological deposits within the area consist of Quaternary or Pleistocene deposits that overly the much older Paleozoic bedrock of the area.

##### **Quaternary Geology**

As interpreted from SLE&C, 2006 (Figures 2.2C and 2.2D), the proposed A-Line corridor runs from north to south across several different materials:

- Glaciolacustrine sand of the Iroquois Plain;
- Paleozoic bedrock (dolostone including limestone, chert, and shale);
- Glaciolacustrine deposits (clay and silt, some fine sand); and
- Several stretches of Halton Till (silty to clayey till).

##### **Paleozoic Geology**

The Paleozoic bedrock consists of Ordovician (older) and Silurian age (younger) rocks. The exposed Ordovician rocks are from the Queenston Formation and consist predominantly of red shale with green siltstone bands. The formation is estimated to be a minimum of 300 m thick, with the upper portions described as weathered in various geotechnical reports (Liberty et. al., 1976). The Georgian Bay Formation, with grey-green shale, siltstones and limestones, underlie the Queenston Formation. Middle Ordovician rocks sit unconformably on the Precambrian basement, which consists of metamorphic rocks of the Grenville area.

Silurian rocks overlie the Ordovician sequence. They are also exposed in the Escarpment and include sandstones, shales, limestones and dolostones. The rocks above the Escarpment include the extensive dolostones of the Guelph, Lockport and Amabel Formations, which, like the underlying rocks, dip gently to the west. The Lockport and Amabel Formations gradually transition from one into the other, with the boundary occurring roughly in the Waterdown area.

As interpreted from SLE&C, 2006 (Figures 2.3C and 2.3D), the proposed A-Line corridor runs across bedrock of the Queenston Formation, Lockport Formation (Vinemount shale beds), Eramosa Member (dark brown or black, bituminous dolostone), and Guelph Formation (brown or tan dolostone).

#### 4.2.4 Hydrogeology

##### **Regional Hydrogeology**

The City of Hamilton is underlain by shallow overburden aquifers and a major regional bedrock aquifer.

Overburden aquifers in the Hamilton Region consist of granular deposits within shallow overburden, and deeper granular units within thicker deposits found within or on the flanks of bedrock valleys, such as the Dundas Valley, where the municipal well at Lynden is located.

The Guelph and Amabel/Lockport Formation dolostones form a major bedrock aquifer throughout the area, supplying water to the municipal wells at Freelon, Carlisle and Greensville. In the Hamilton area, this aquifer is referred to as the Guelph-Amabel Aquifer. To the south, it is known as the Guelph-Lockport Aquifer. It is considered to be one of the major aquifers in Ontario. In the Niagara Peninsula, this aquifer has a maximum thickness of more than 60 m. However, in the vicinity of the Carlisle and Freelon municipal wellfields, where the Guelph Formation is absent, the aquifer thickness is significantly less, being in the order of 13 to 27 m.

Limestones and dolostones are typically rocks with low primary permeability, but frequently with a relatively high secondary permeability due to the presence of solution channels that develop along faults, fractures

and bedding planes. The aquifers in the Freelon, Carlisle and Greensville areas are no exception, with the bulk of the well yields being derived from secondary features.

As shown in SLE&C, 2006 (Figure 2.3), the Guelph-Amabel/Guelph-Lockport Aquifer extends beneath much of the City of Hamilton and is available as a source of water throughout the area. However, it has only been developed as a source for Municipal Water Supply in the area north of the Dundas Valley.

As interpreted from SLE&C, 2006 (Figure 2.7), the proposed A-Line corridor crosses aquifers in both the overburden and bedrock.

### **Local Hydrogeology**

Below the Niagara Escarpment, the general direction of groundwater flow is toward Hamilton Harbour and Lake Ontario (SLE&C, 2006, Figures 3.12C and D). The Hamilton International Airport near Mount Hope has the highest groundwater table elevation of approximately 230 m amsl. To the north, the groundwater table decreases to approximately 190 m amsl near the Niagara Escarpment, and then drops abruptly to around 100 m amsl at the foot of the Niagara Escarpment, and drops further to approximately 75 m amsl at the Lake Ontario shoreline. To the south of the Airport, the groundwater table decreases to approximately 190 m amsl near the Grand River (the Town of Caledonia).

## **4.3 Recharge and Discharge Areas**

As interpreted from SLE&C, 2006 (Figures 3.14C and 3.14D), there is a predominance of groundwater recharge (areas with downward vertical gradients) south of the Escarpment, with only minor discharge areas. The surficial deposits in the recharge areas are predominantly glaciolacustrine silt, which have relatively low permeability, allowing only limited downward flow of water for recharge of deep groundwater. Most of the streams and watercourses appear to reflect surface water drainage and, therefore, are not significantly affected by groundwater flow.

The northern portion of the proposed A-Line corridor consists of a discharge area around the foot of the Niagara Escarpment, and a recharge area near the Hamilton Harbour.

Groundwater recharge and discharge areas are associated with the potential for groundwater contamination. For instance, in a recharge area, contaminants that infiltrate to the water table will be transported with downward flowing groundwater and may impact an underlying aquifer. In contrast, in discharge areas, groundwater contamination of the water table may still occur but downward migration is minimal; hence, potential impacts on an underlying aquifer will be less pronounced, if any.

### **4.3.1 Areas Vulnerable to Groundwater Contamination**

As interpreted from SLE&C, 2006 (Figure 3.24), the groundwater along the proposed A-Line corridor has high to medium contaminant vulnerability between Lake Ontario and the Escarpment, and low vulnerability south of the Escarpment, especially near the Airport.

Groundwater vulnerability is related to several factors:

- The water table is shallow;
- The overburden is either very thin or absent in much of this area; and
- The predominant aquifer is fractured bedrock.

The combination of these conditions results in groundwater being considered as having medium to high contaminant vulnerability. In the vicinity of the Airport, the groundwater vulnerability is low because the predominantly clayey surficial deposits limit downward infiltration of potential contaminants.

### **4.3.2 Potential for Encountering Soil and Groundwater Contamination**

An overview study of the proposed A-Line corridor was conducted with the purpose of identifying any properties/areas with the potential for site contamination. No historical data from previous investigations

were available; therefore, the main activities performed to achieve the objective of the study were limited to the following:

- A street directory search of adjacent properties along the A-Line;
- A high-level site visit (windshield survey); and,
- Review of historical fire insurance plans.

The work commenced with gathering all available existing information regarding the properties and businesses adjacent to the proposed A-Line corridor using online business directories, Yellow Pages, and other information available online. This information formed the initial input into the list of potentially contaminated sites.

The field work involved a windshield survey in order to confirm the findings of the street directory search and also to identify any additional properties with the potential for site contamination. The windshield survey was conducted by proceeding along the optional BRT and LRT routes (wherever possible on foot), and recording information, and taking pictures of the properties of interest from public property. The information collected during this phase of the evaluation was compared with the directory search results.

A search for historical fire insurance maps of the properties along the proposed routes was conducted for any evidence of previous activities that may suggest the potential presence of contamination. City of Hamilton Fire Insurance Plans, Volumes 1 to 5 (1960 to 1964) provided coverage for James Street and parts of Upper James Street.

The street directory search identified several sites with potential contamination situated along the proposed A-Line corridor, based on the nature of activities conducted at the sites. Therefore, it is possible that contaminated soil and groundwater may be encountered at these sites during construction of the proposed A-Line route, depending on the final design and the type of work that will be required to be conducted at or adjacent to the corridor during construction.

The windshield survey confirmed the location of the sites identified by the street directory search, but did not identify other areas of potential contamination.

Examination of the City of Hamilton historical fire insurance plans identified several properties that were once present that may have resulted in soil and/or groundwater contamination.

The list of potentially contaminated sites identified as part of this study is presented in Table 4.1 below.



Table 4.1: List of Sites with Potential for Soil and Groundwater Contamination

Business Name	Address	Street Directory	Windshield Survey	Fire Insurance Plans	Potential Contamination
Harley's Electrical Services Ltd.	9061 and 9027 Airport Rd.	Listed	Observed	Not Confirmed	PCBs, hydrocarbons etc.
Auto Repair Shop	3155 Homestead Drive	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Auto Repair Shop	3130 Homestead Dr	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Larry Armes Machine Ltd	3102 Homestead Dr	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Hamilton Sod	2907 Upper James St.	Listed	Observed	Not Confirmed	Nitrogen and Phosphorus
Cameron Speedway and Amusements	2633 Upper James St.	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils
Fix Auto Hamilton Mountain	2481 Upper James St , Unit 4	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Assured Automotive Inc.	2179 Upper James	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Mountain Mazda	1977 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
KIA of Hamilton	1885 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
ACT Automotive Services	1832 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Lubricare	1821 Upper James	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Pioneer Gas Station	1822 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons
Mountain Hyundai	1739 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Napa Autopro	1699 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Autoprice	1666 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Bay King Motors	1655 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.

Business Name	Address	Street Directory	Windshield Survey	Fire Insurance Plans	Potential Contamination
Hasky Gas Station	5 Rymal Rd W	Listed	Observed	Confirmed (Page 531, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Shell Gas Station	1625 Upper James St	Not Listed	Not Identified	Confirmed (Page 531, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
As Traded Car Dealership	1600 Upper James St	Listed	Observed	Confirmed (Page 531, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Gas Station	1597 Upper James St	Not Listed	Not Identified	Listed (Page 531, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Gas Station	1596 Upper James St	Not Listed	Not Identified	Listed (Page 531, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Nethercott Chevrolet	1591 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Oliver Farm Equipment Repair	1589 Upper James Street	Not Listed	Not Identified	Listed (Page 531, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Nissan Canada	1545 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Hamilton Mitsubishi	1515 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Sterling Honda	1495 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Budds BMW	1471 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Gas Station	1402 Upper James St	Not Listed	Not Identified	Listed (Page 530, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Johnston Chrysler	1350 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Esso Gas Station	1341 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Midas Hamilton	1243 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils,

Business Name	Address	Street Directory	Windshield Survey	Fire Insurance Plans	Potential Contamination
					Heavy metals, etc.
Hamilton Volkswagen	1221 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Johnbear Pontiac Buick Cadillac Ltd	1200 Upper James	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Gas Station	1103 Upper James St	Not Listed	Not Identified	Listed (Page 529, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Gas Station	1020 Upper James St	Not Listed	Not Identified	Listed (Page 529, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Hubert H&C (Sheet Metal Shop)	1019 Upper James St	Not Listed	Not Identified	Listed (Page 529, Volume 5, 1960)	Solvents, Oils, Heavy Metals, etc.
Mister Transmission	1011 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Upper James Toyota	999 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Beech Motors	990 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Part Source	983 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Active Green and Ross	955 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Mohawk Ford	930 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Esso Gas Station	917 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Petro Canada Gas Station	914 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Hasky Gas Station	878 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons
Gas Station	873 Upper James St	Not Listed	Not Identified	Listed (Page 522, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Gas Station	872 Upper James St	Not Listed	Not Identified	Listed (Page 522,	Petroleum Hydrocarbons, Oils,

Business Name	Address	Street Directory	Windshield Survey	Fire Insurance Plans	Potential Contamination
				Volume 5, 1960)	Heavy metals, etc.
Pioneer Gas Station	859 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons
Canadian Tire Gas Station	314 Main St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons
Mohawk Garage	857 Upper James St	Not Listed	Not Identified	Listed (Page 522, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Gas Station	831 Upper James St	Not Listed	Not Identified	Listed (Page 522, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
CBLK Auto Repair Shop	826 Upper James St	Not Listed	Not Identified	Listed (Page 522, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Gas Station	814 Upper James St	Not Listed	Not Identified	Listed (Page 522, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Petro Canada Gas Station	813 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons
Canadian Tire Gas Station	777 Upper James St	Listed	Observed	Not Confirmed	Petroleum Hydrocarbons
Dry Cleaning	732 Upper James St	Not Listed	Not Identified	Listed (Page 521, Volume 5, 1960)	Chlorinated Solvents
Gas Station	720 Upper James St	Not Listed	Not Identified	Listed (Page 521, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Gas Station	681 Upper James St	Not Listed	Not Identified	Listed (Page 512, Volume 5, 1960)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Auto Repair Shop	157 Upper James St	Not Listed	Not Identified	Listed (Page 157, Volume 1, 1964)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Auto Repair Shop	180 James St. N	Not Listed	Not Identified	Listed (Page 152-1, Volume 1, 1964)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Auto Repair Shop	484 James St. N	Not Listed	Not Identified	Listed (Page 102-5, Volume 1, 1964)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Midland	3 Picton St. E	Not	Not	Listed	Petroleum



Business Name	Address	Street Directory	Windshield Survey	Fire Insurance Plans	Potential Contamination
Superior Express Ltd.		Listed	Identified	(Page 102-2, Volume 1, 1964)	Hydrocarbons, Oils, Heavy metals, etc.
Auto Repair Shop	587 James St. N	Not Listed	Not Identified	Listed (Page 102-1, Volume 1, 1964)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Auto Repair Shop	1 Burlington St	Not Listed	Not Identified	Listed (Page 100-4, Volume 1, 1964)	Petroleum Hydrocarbons, Oils, Heavy metals, etc.
Dowsar Marine Supplies	522 James St. N	Listed	Observed	Not Confirmed	Solvents, Oils, Heavy Metals, etc.

The overall search identified 66 sites that could be associated with potential contamination along the A-Line corridor. The number of sites listed in the street directory was 43, and all of their locations were confirmed during the windshield survey. The historical review, limited to only the examination of City of Hamilton fire insurance plans, identified 23 additional sites with potential contamination, of which only one gas station, located at 5 Rymal Road West, was listed in the street directory search and observed during the windshield survey. The breakdown of the identified sites by business type is summarized in Table 4.2. The approximate locations of sites, identified by type, are provided on Figures 4.1 through 4.5.

Figure 4.1: Sites with Potential for Soil and Groundwater Contamination

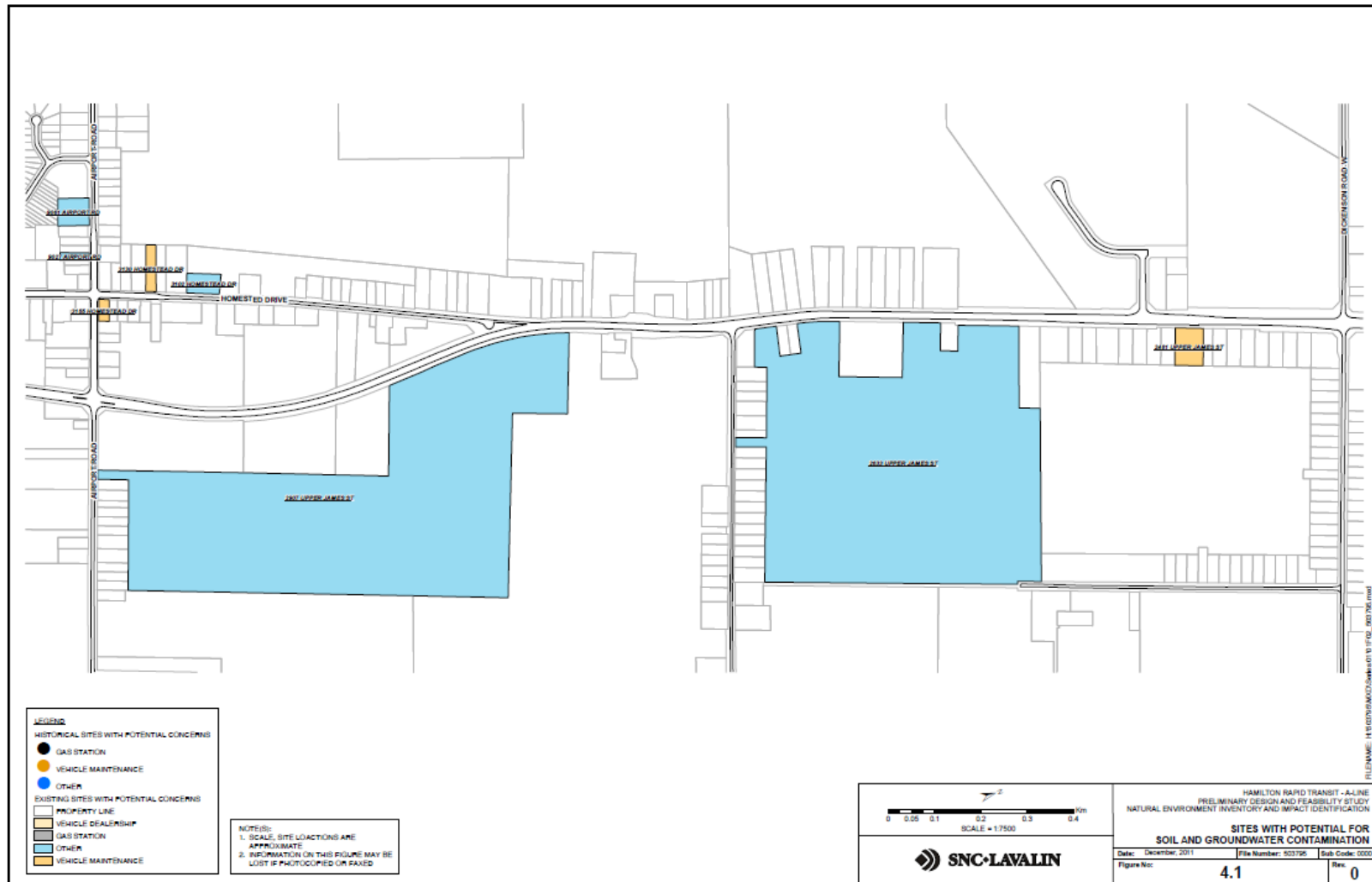


Figure 4.2: Sites with Potential for Soil and Groundwater Contamination



Figure 4.3: Sites with Potential for Soil and Groundwater Contamination

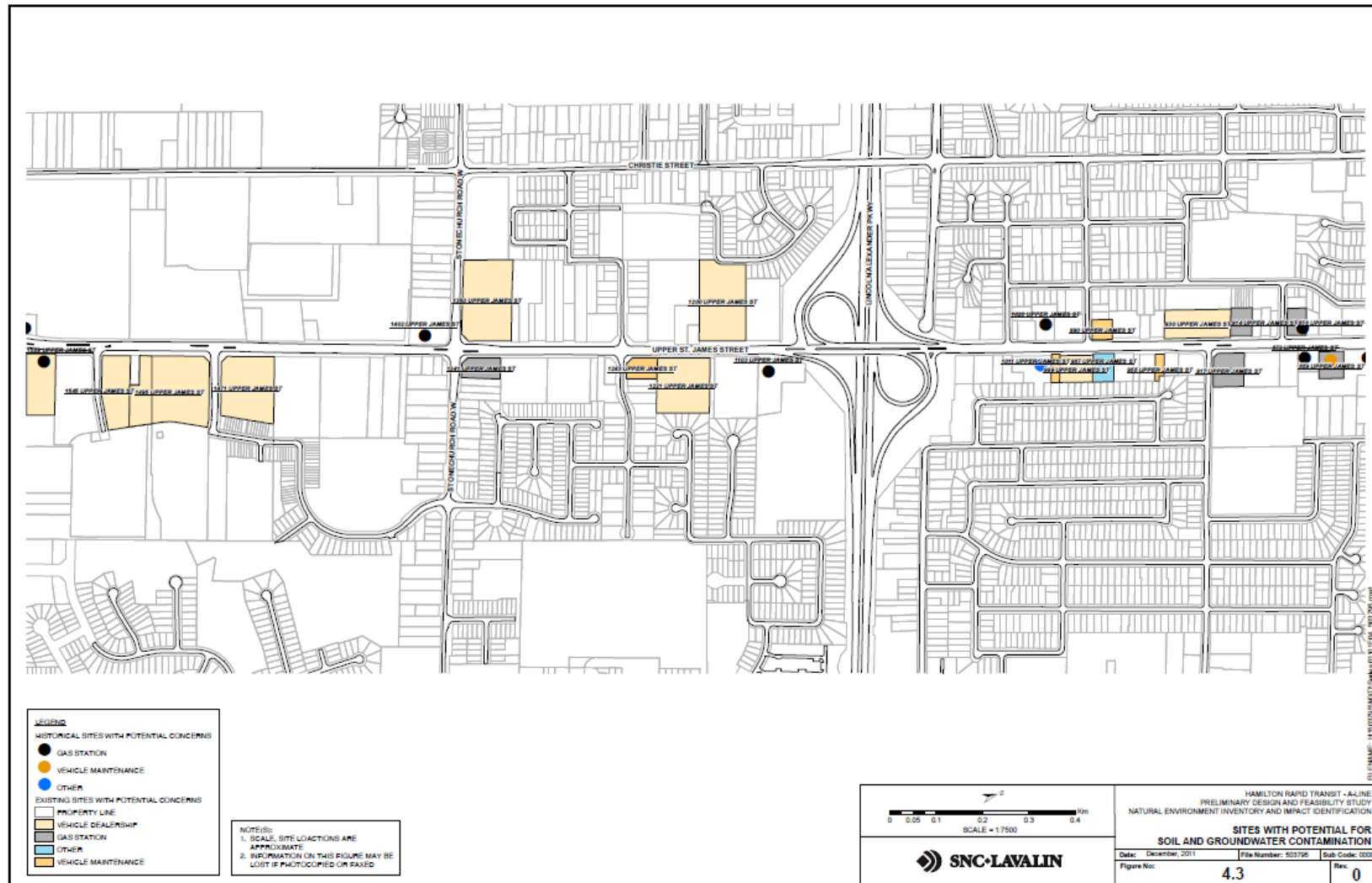




Figure 4.4: Sites with Potential for Soil and Groundwater Contamination

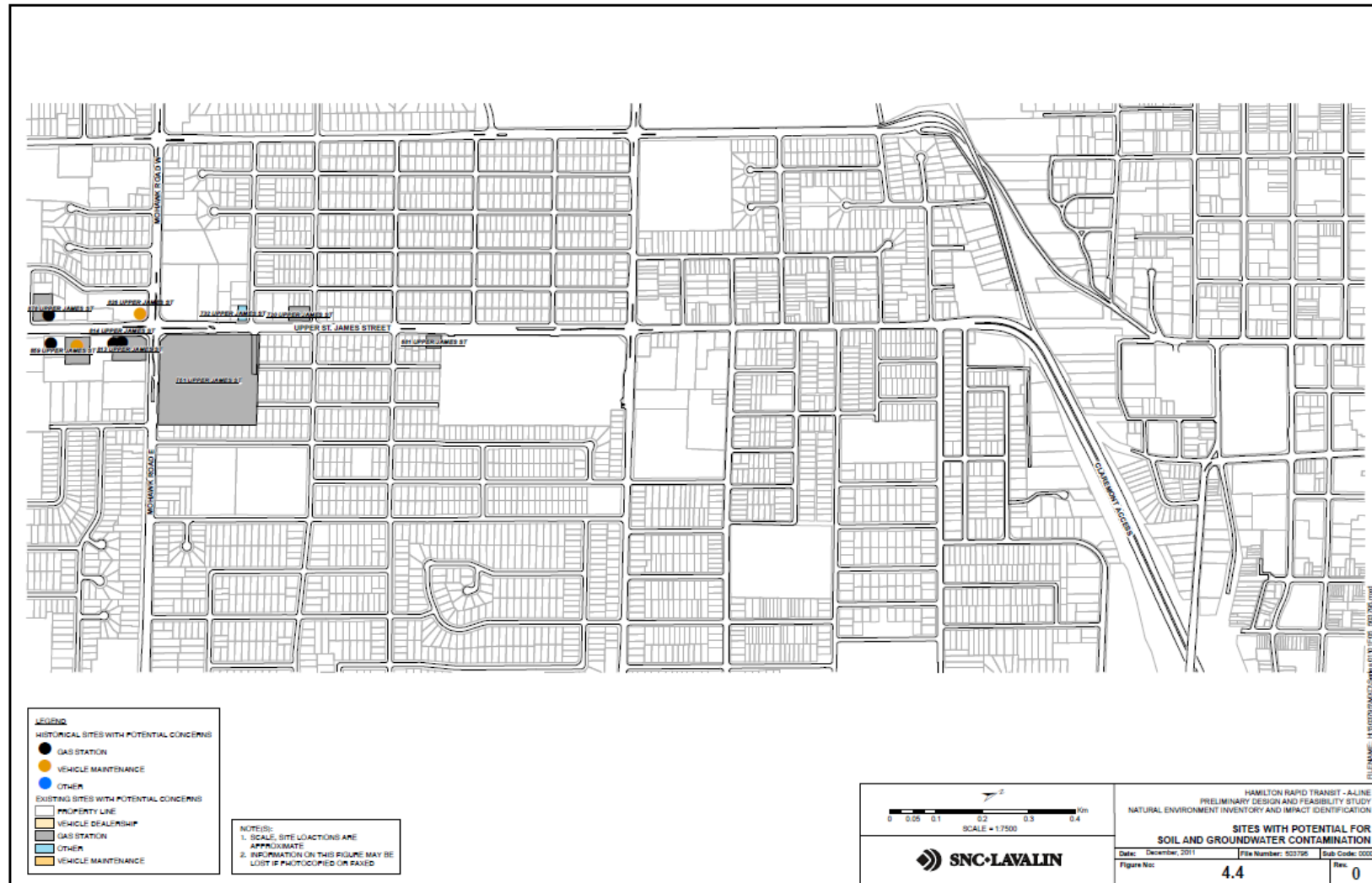
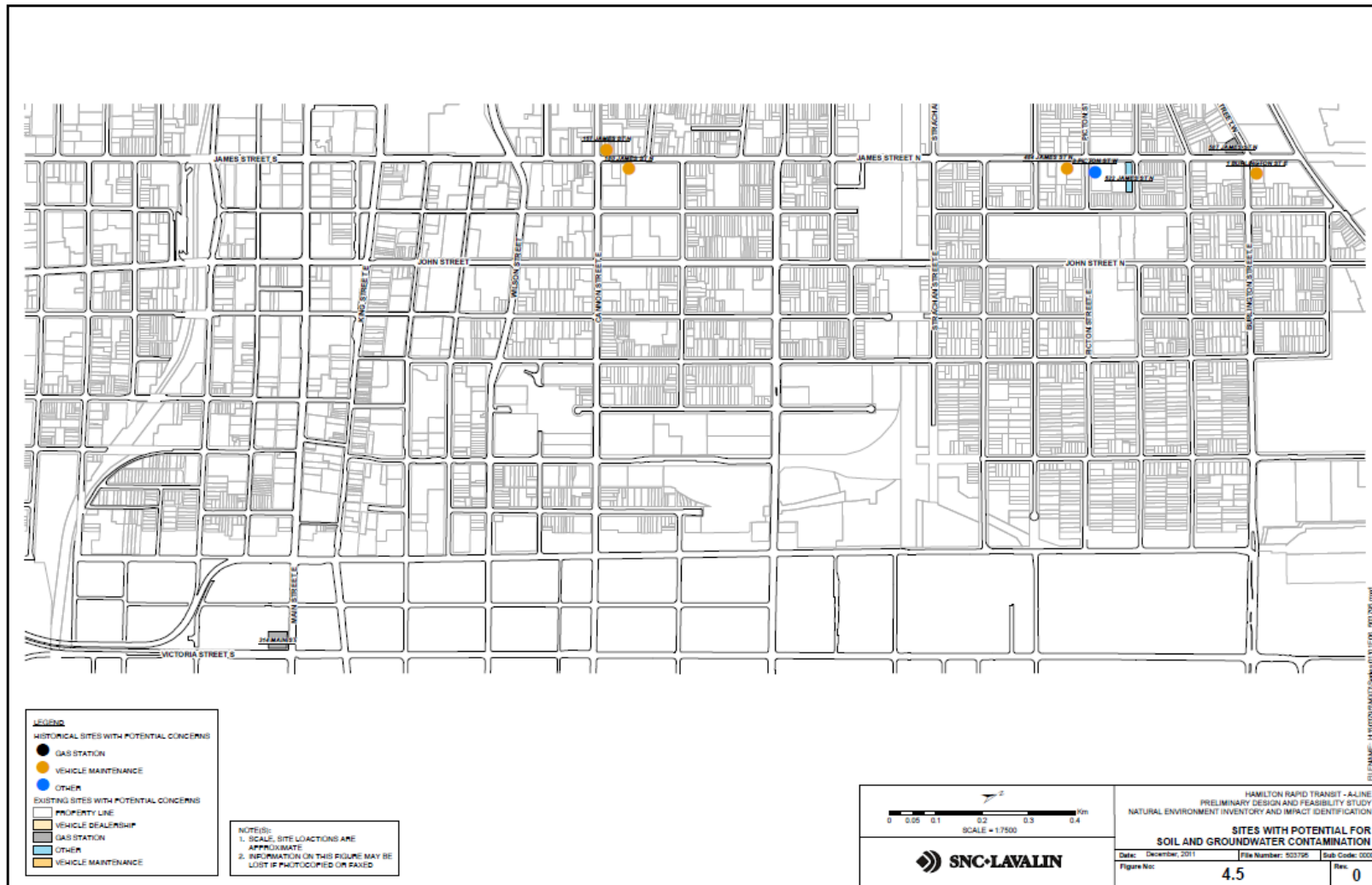


Figure 4.5: Sites with Potential for Soil and Groundwater Contamination



**Table 4.2: Summary of Potential Contaminated Sites by Type**

Business Type	Present	Historical	Total
Gas Station	11	12	23
Auto/Farm Repair/Maintenance	14	8	22
Car Dealership	16	-	16
Electrical Services	1	-	1
Dry-cleaning	-	1	1
Agricultural	1	-	1
Metal Processing	-	1	1
Truck Yard	-	1	1
Marine Supplies	1	-	1

The potentially contaminated sites search also included the recommended BRT route, which follows the same alignment as the LRT except for the section between King Street and James Mountain Road, where the route continues along James Street South. No properties/areas with potential for site contamination were identified along this section.

It is recommended that, where possible, properties that may impact or be impacted by construction activities should be subject to a Phase I Environmental Site Assessment in order to better identify and characterize potential for contamination. Contingency plans to handle potentially impacted soil and/or contaminated water generated during potential dewatering activities should be developed in the Detail Design phase of the project.

Any soils from properties suspected to be contaminated that are to be removed during the construction phase should be tested for contaminants that may have been used or dumped along the corridor limits and if contamination is present, provisions in the City of Hamilton Contaminated Sites Management Program for Municipal Works and appropriate soil management practices are to be implemented.

#### 4.3.3 Existing Groundwater Usage and Source Water Protection

The Halton-Hamilton Source Protection Committee (2010) summarized groundwater usage, wellhead protection area and recommended a groundwater protection action plan. This section summarizes those parts that directly relate to the proposed A-Line RT project.

##### **Source Water Protection**

The Halton-Hamilton Source Protection Committee (2010) proposed Sources Water Protection Areas for the current surface and groundwater usages within the greater Hamilton region. Based on this report, Source Water Protection Area does not exist along the proposed A-Line corridor.

##### **Well Head Protection Areas**

Wellhead Protection Areas (WHPA) encompass the total area of land that contributes water to a municipal well to the capacity of the *municipal drinking-water supply systems*, as well as the length of time groundwater within the WHSA will take to reach the municipal drinking-water supply well. The closest Wellhead Protection Area (Greensville well field) is located approximately 9 km northwest of the proposed A-Line route (Halton-Hamilton Source Protection Committee, 2010, Figure 4.4) and would not be impacted by this project.

##### **GUDI Wells**

Groundwater under the direct influence of surface water (GUDI) wells draw groundwater that is directly connected to and dependent upon surface water. The closest GUDI well (Greensville), which is located approximately 9 km northwest of the proposed A-Line route, would not be impacted by this project.



### **Existing Groundwater Usage**

The Halton-Hamilton Source Protection Committee (2010) also summarized existing groundwater usage, using the MOE Permit to Take Water (PTTW) database. The closest PTTW site, for the purpose of groundwater remediation, is located at a site near the western inner Hamilton Harbour (Halton-Hamilton Source Protection Committee, 2010, Figure 5.4). This PTTW site is located approximately 1 km west of the proposed A-Line route, and would not be impacted by this project.

## **4.4 Project Environmental Effects, Mitigation and Monitoring**

### **4.4.1 Natural Environment**

#### **Hydrogeology and Groundwater**

The proposed A-Line corridor runs through various soil types, including Iroquois Plain glaciolacustrine deposits (clay and silt, some fine sand), Paleozoic bedrock (chert, shale and dolomite including limestone) and Halton Till (silty to clayey till).

The groundwater table along the proposed A-Line corridor ranges from approximately 190 m amsl (immediately south of the Escarpment) to approximately 230 m amsl (in the vicinity of the Hamilton International Airport), and ranges from approximately 75 m amsl (at the Lake Ontario shoreline) to 100 m amsl (at the foot of the Escarpment). The groundwater table drops abruptly from the top of the Escarpment to the foot of the Escarpment.

Groundwater generally has medium to high contaminant vulnerability. This results from relatively shallow water tables, frequently thin or absent soils, and the presence of fractured bedrock.

For the most part, the proposed A-Line RT construction will involve widening of the existing roadway, with minor cut and fill site grading operations. No extensive soil or groundwater impacts are anticipated.

#### **Construction/Operations Impacts**

The following localized impacts may occur during construction:

- Shallow groundwater levels may be temporarily affected if dewatering is required for excavation. If required, a Permit to Take Water application will be prepared and submitted to the MOE for approval in accordance with Ontario Regulation 387/04, as amended. The application document will include detailed and appropriate evaluation of geological and hydrogeological conditions of the subject area;
- Some contaminated soil and groundwater may be encountered and will require proper handling in accordance with applicable City and Provincial environmental regulations; and
- Soil or groundwater contamination may occur from excavation (leaching of contaminants into groundwater), construction equipment and/or associated spills.

#### **Mitigation Measures and Net Effects**

Mitigation plans to address the above mentioned construction impacts will be developed based on construction methods developed in the Detail Design phase, completion of geotechnical testing along the route, and an update of potential and actual sources of contaminated sites along the route during detailed design. Construction equipment should be maintained in good working order with appropriate safety and emergency measures. Contingency plans will be developed to minimize potential soil or groundwater contamination and/or associated spills.

#### **Monitoring**

An overall monitoring plan is not required. Temporary or localized plans can be prepared. Where groundwater may impact surface water, a hydrologist will be consulted for input to these plans (e.g., in proximity to headwater/tributary areas).

#### 4.4.2 Contaminated Property

##### **Contaminated Soils**

A windshield survey conducted by SNC-Lavalin Inc. in October 2010 indicated that as many as sixty-six (66) properties within the study area have the potential to contribute to environmental contamination.

Potential impacts associated with disturbance of contaminated soils include runoff of contaminated materials into watercourses, the airborne transmission of fine contaminated particulates, and leaching of contaminants into groundwater. Ontario Regulation 153/04, as amended will be applied with respect to the removal and/or movement of soils to minimize the potential impacts. If contaminated sites are positively identified in or adjacent to the construction area, the MOE District Office will be contacted.

##### **Construction/Operations Impacts**

There is the potential for construction works to encounter contaminated soil and/ or groundwater during construction. No impacts are anticipated during future LRT operations.

##### **Mitigation Measures and Net Effects**

Where removal of potentially contaminated soil must take place, soils will be tested for those chemicals that may have been used or deposited within the area, and will be handled in accordance with Part XV.I of the *Environmental Protection Act* (EPA) and Ontario Regulation 153/04 (as amended).

##### **Monitoring**

Phase I Environmental Site Assessments and, potentially, Phase II Environmental Site Assessments should be undertaken during subsequent design phases of the project, as required.

## REFERENCES

- Aquafor Beech Limited. May 2007. City of Hamilton Stormwater Master Plan – Class Environmental Assessment Report (City-Wide).
- Bowlby, J.N., K. McCormack, and M.G. Heaton. 2009. Hamilton Harbour and Watershed Fisheries Management Plan. Ontario Ministry of Natural Resources and Royal Botanical Gardens.
- Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier. 2007. Atlas of the Breeding Birds of Ontario – Square 17MJ44. Available online at:  
<http://www.birdsontario.org/atlas/index.jsp?lang=en>
- Chapman, L.J and D.F. Chapman, 1966. The Physiography of Southern Ontario. Published for the Ontario Research Council by The University of Toronto Press.
- City of Hamilton. October 1998. Red Hill Creek Watershed Action Plan: First Generation Plan Hamilton Wentworth.
- City of Hamilton. 2005. Environmentally Significant Areas – Map No. 4. Available online at:  
<http://www.hamilton.ca/NR/rdonlyres/66E0C663-2524-4B1D-A612-37B797D1F598/0/RegionMap4.pdf>
- Class EA Ecological Assessment Requirements for Baseline Conditions, S. Faulkenham, Hamilton Conservation Authority, March 26, 2009.
- COSEWIC (Committee for the Status on Endangered Wildlife in Canada). 2009. Database of Wildlife Species Assessed by COSEWIC. Last updated July 15, 2009. Available online at:  
[http://www.cosewic.gc.ca/eng/sct1/searchform\\_e.cfm](http://www.cosewic.gc.ca/eng/sct1/searchform_e.cfm)
- C. Portt and Associates. April 2003. Fisheries and the Red Hill Creek Realignment Study.
- Dillon Consulting. April 2000. City of Hamilton Airport Employment Growth District – Phase 2. Draft Subwatershed Study and Draft Stormwater Master Plan.
- Dillon Consulting. March 2009. City of Hamilton Rapid Transit Initiative Terrestrial and Avian Ecology Report.
- Dillon Consulting. May, 2010. City of Hamilton Airport Employment Growth District Transportation Master Plan.
- Dobbyn, J.S. 1994. Atlas of the Mammals of Ontario. Federation of Ontario Naturalists. Halton-Hamilton Source Protection Committee, 2010. Proposed Assessment Report, Hamilton Region, Source Protection Area. November 2010.
- Dwyer, Jill, K., Jay M. Lindsay, 2003, Nature Counts Project, Hamilton Natural Areas Inventory.



- Hamilton Conservation Authority. 2010. Hamilton Waterfalls. Hamilton Escarpment. Available online at: <http://www.waterfalls.hamilton.ca/default.asp?ESA=9>
- Hamilton Conservation Authority (HCA) ESA Site Summaries ESA #'s 42, 52, and 48 - Area Codes DUND-15, HamI-69, and HamI-66.
- Liberty, B.A., I.J. Bond, and P.G. Telford, 1997. Paleozoic Geology, Hamilton, Southern Ontario. Ontario Division of Mines, Map 2336, scale 1:50,000. January 1976.
- Newmaster, S. G., A. Lehela, P. W. C. Uhlig, S. McMurray, and M. J. Oldham. 1998. Ontario Plant List. Ontario Ministry of Natural Resources, Ontario Forest Research Institute, Sault Ste. Marie, Ontario, Forest Research. Information Paper Number 123, 550 pages + appendices.
- Niagara Escarpment Commission (NEC). 2005. Exerpt of Niagara Escarpment Plan Map – Map No. 59. Available online at: [http://www.escarpment.org/\\_files/file\\_nep\\_map59.pdf](http://www.escarpment.org/_files/file_nep_map59.pdf) Niagara Peninsula Conservation Authority. Email correspondence. 2010.
- Niagara Peninsula Conservation Authority. 2010. Upper Welland River Watershed Plan. Phase 1.
- Oldham, M.J. and W.F. Weller. 2000. Ontario Herpetofaunal Atlas. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. Available online at: <http://www.mnr.gov.on.ca/MNR/nhic/herps/ohs.html>
- OMNR Natural Heritage Information Center (NHIC) website 2010. Species Searches (<https://www.biodiversityexplorer.mnr.gov.on.ca/nhicWEB/mainSubmit.do>) [accessed 25 Sept 2010].
- OMNR Species at Risk in Ontario (SARO) List. updated September 11, 2009. (<http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/276722.html>) [accessed 25 Sept 2010].
- OMNR. 2009. Species at Risk in Ontario (SARA) List. Last updated September 11, 2009. <http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/276504.html> (Accessed October 2010).
- OMNR. 2010. Natural Heritage Information Centre: Biodiversity Explorer. <https://www.biodiversityexplorer.mnr.gov.on.ca/nhicWEB/mainSubmit.do> (Accessed October 2010).
- OMNR. 2011. Habitat Regulations Under The ESA 2007. Website URL: <http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/268554.html>. Accessed November 2011.
- Ontario Ministry of Natural Resources (OMNR). 2000. Significant wildlife habitat technical guide: Appendix G. [http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@fw/documents/document/mnr\\_e001287.pdf](http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@fw/documents/document/mnr_e001287.pdf) (Accessed November 2010).

- Ontario Ministry of Natural Resources (OMNR) Natural Areas Reports Area ID's 7025, 1148, 5393, (Accessed October 2010).
- Ontario Ministry of Natural Resources. February 2000. Fisheries Management Guidelines.
- Ontario Nature. 2011. Reptiles and Amphibians of Ontario. Website URL: [http://www.ontarionature.org/protect/species/reptiles\\_and\\_amphibians/index.php](http://www.ontarionature.org/protect/species/reptiles_and_amphibians/index.php). Accessed November 2011.
- Philips Engineering Ltd. September 2003. Mountain Brow Boulevard Crossing and Central Mountain Stormwater Management Class Environmental Assessment City of Hamilton.
- Presant, E.W., R.E. Wicklund, and B.C. Matthews. 1965. The Soils of Wentworth County. Report No. 32 of the Ontario Soil Survey. Canada Department of Agriculture, Ottawa and Ontario Department of Agriculture, Toronto.
- Regional Municipality of Hamilton-Wentworth, 2005. Towards a Sustainable Region. Hamilton-Wentworth Official Plan. June 2005.
- SNC-Lavalin Inc. and Charlesworth & Associates (SLI-C&A), 2006. Hamilton Groundwater Resources Characterization and Wellhead Protection Partnership Study. Report to City of Hamilton. April 2006.
- Stanfield L. (editor). 2010. Ontario Stream Assessment Protocol. Version 8.0. Fisheries Policy Section. Ontario Ministry of Natural Resources. Peterborough, Ontario. 376 pages.
- Urban Hamilton Official Plan, Schedule B, Natural Heritage System, July 2009.
- Vlasman, K. 2003. Mammal of Hamilton In: Nature Counts Project: Hamilton Natural Areas Inventory 2003 – Species Checklists (J.K. Dwyer, ed.). Hamilton Naturalists' Club. 26 pp.

#### Websites

- COSEWIC. 2009. Canadian Wildlife Species at Risk. Committee on the Status of Endangered Wildlife in Canada.  
[http://www.cosewic.gc.ca/eng/sct0/rpt/rpt\\_csar\\_e.cfm](http://www.cosewic.gc.ca/eng/sct0/rpt/rpt_csar_e.cfm)
- OMNR Natural Heritage Information Center (NHIC) website 2010 Species Searches.  
<https://www.biodiversityexplorer.mnr.gov.on.ca/nhicWEB/mainSubmit.do>
- OMNR Species at Risk in Ontario (SARO) List. updated September 11, 2009.  
<http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/276722.html>
- Species at Risk Act (SARA), Ministry of Environment.  
[http://www.sararegistry.gc.ca/sar/index/default\\_e.cfm](http://www.sararegistry.gc.ca/sar/index/default_e.cfm)

# **Appendix A**

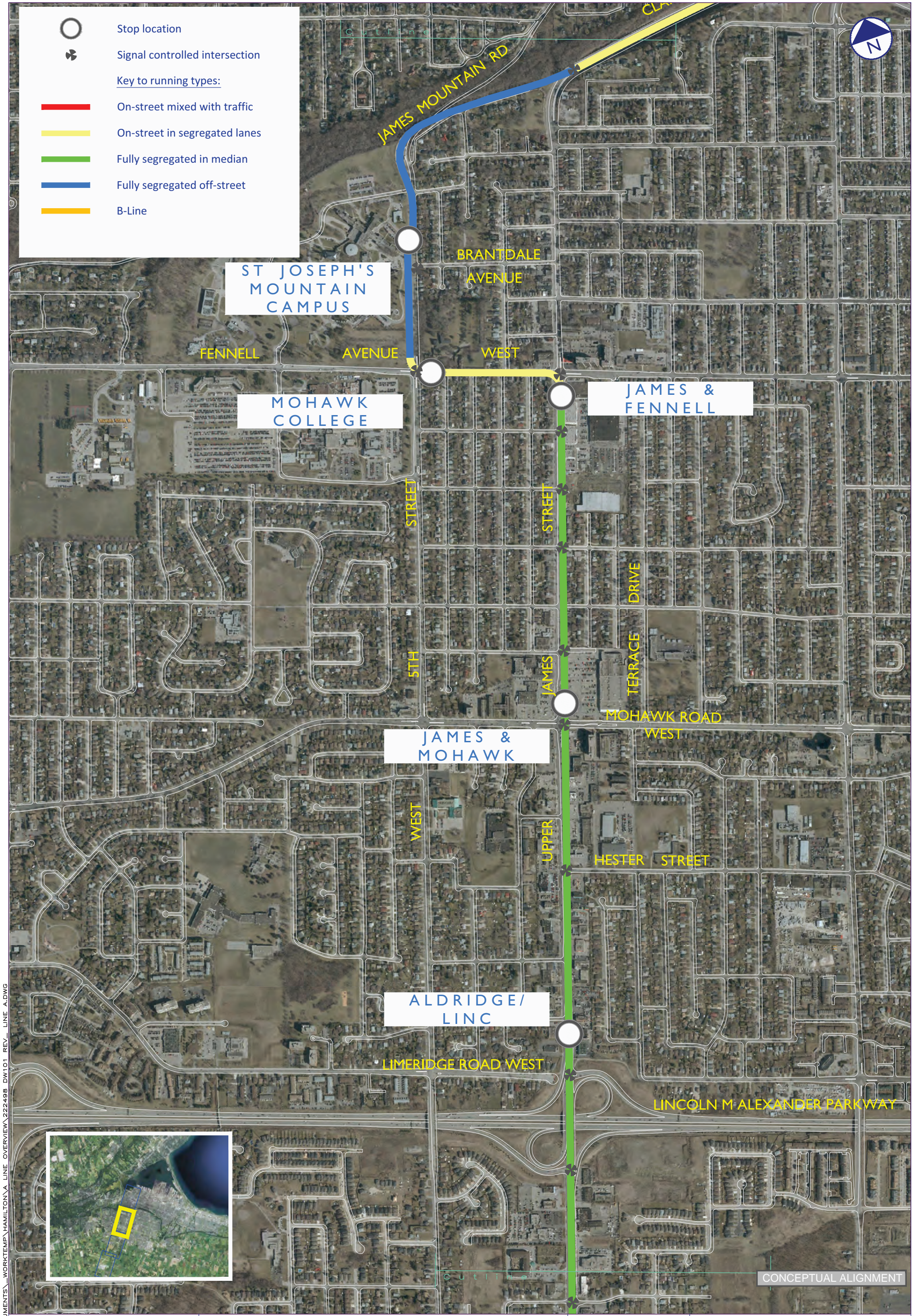
# **Alignments**





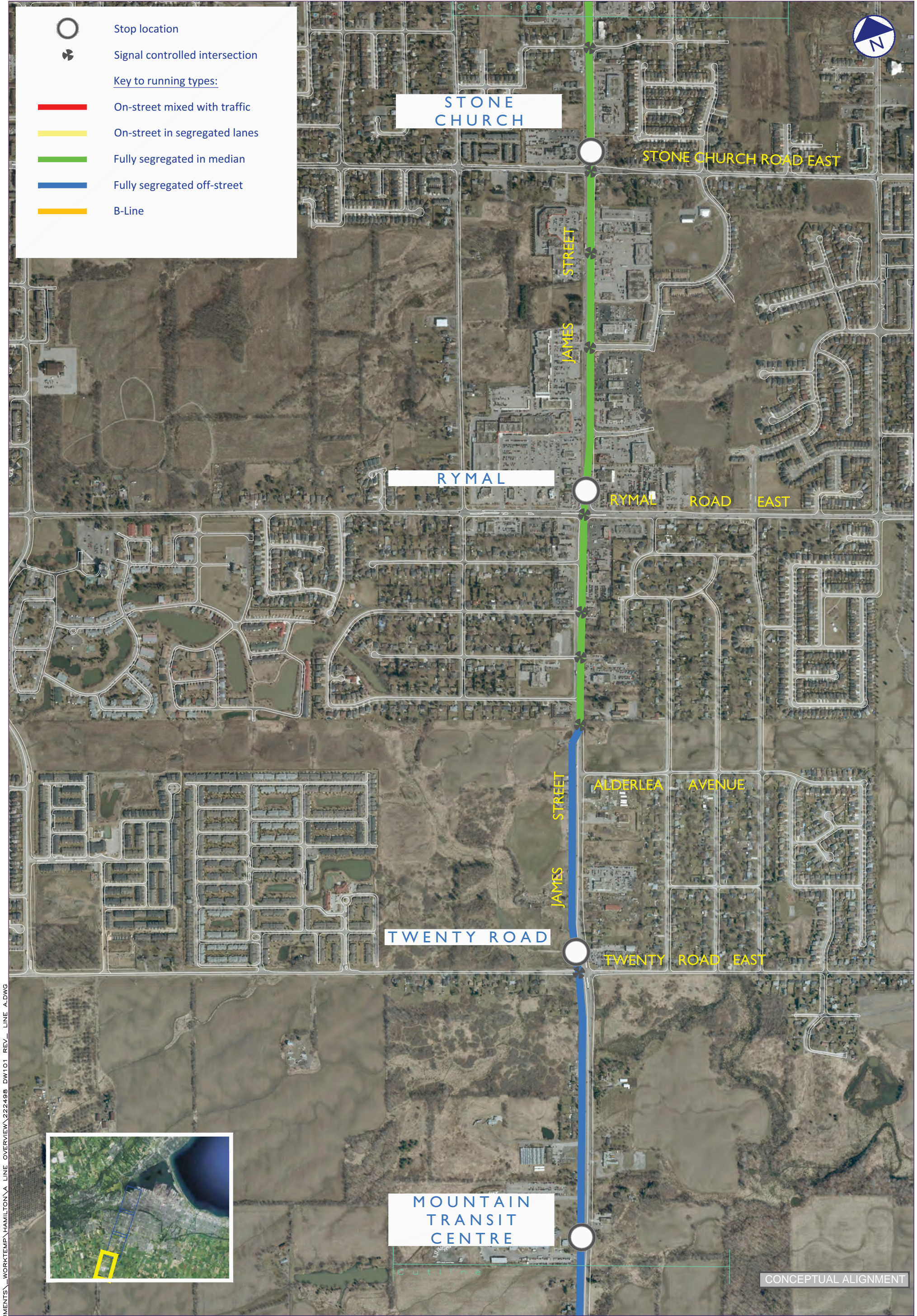
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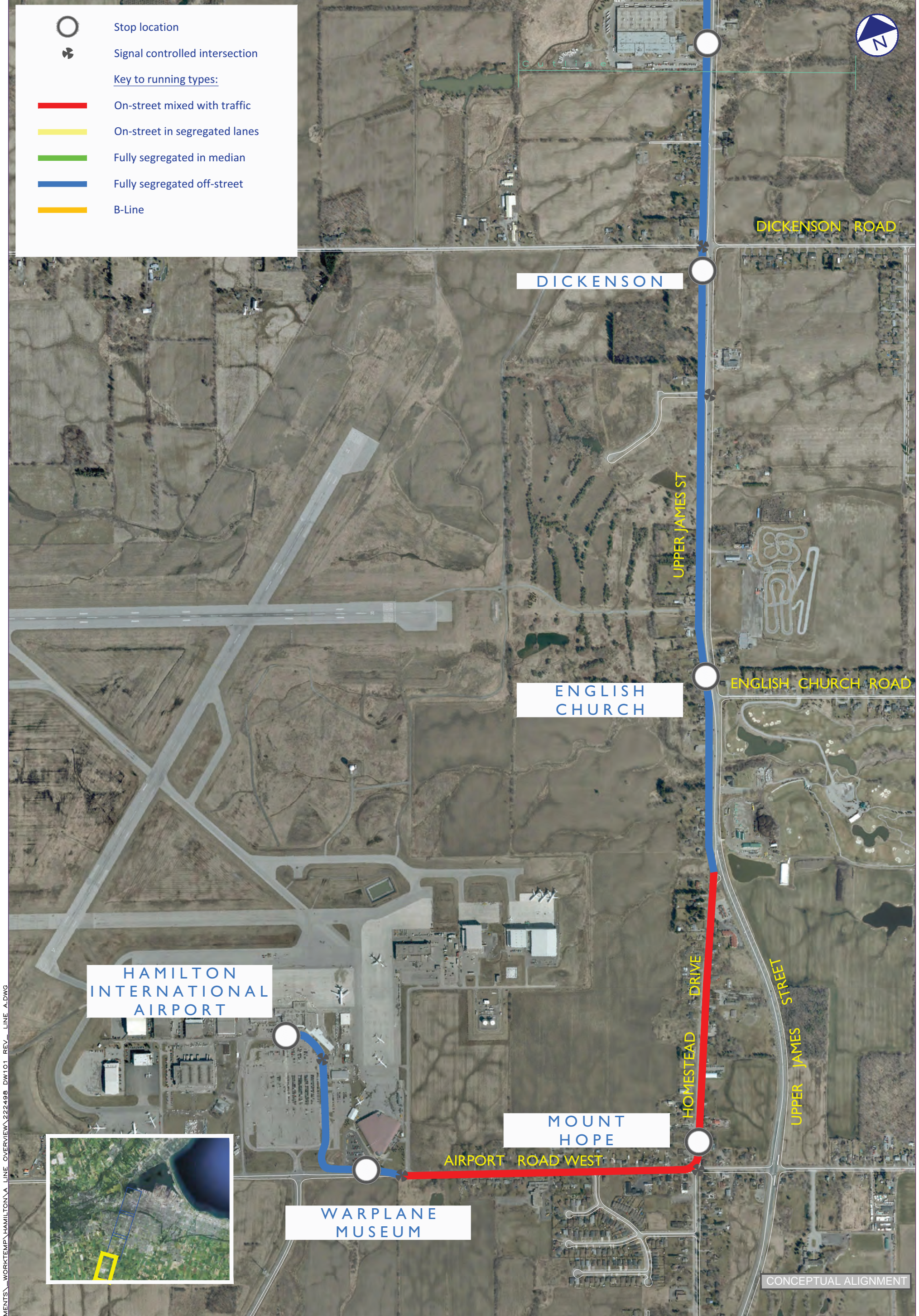
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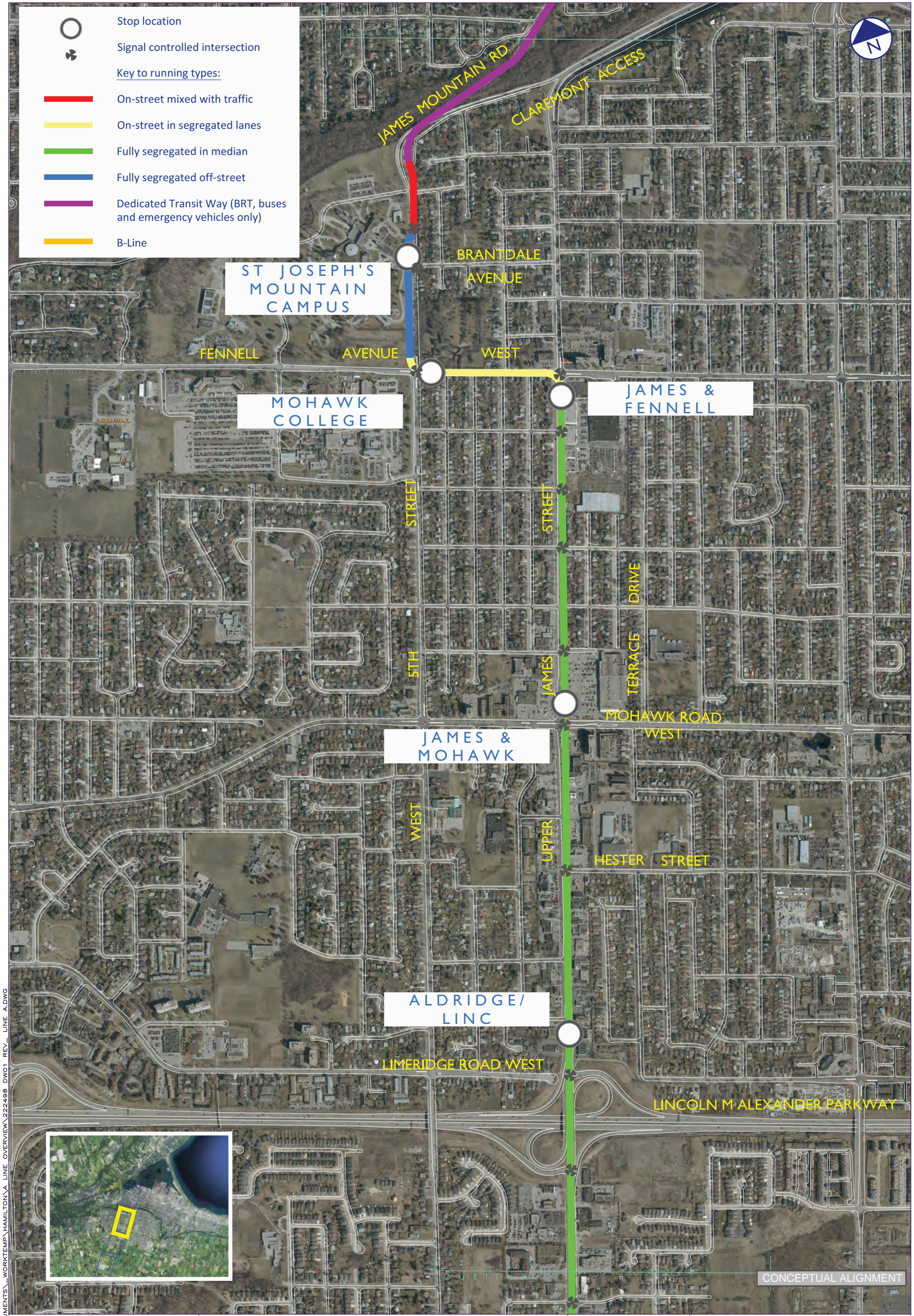
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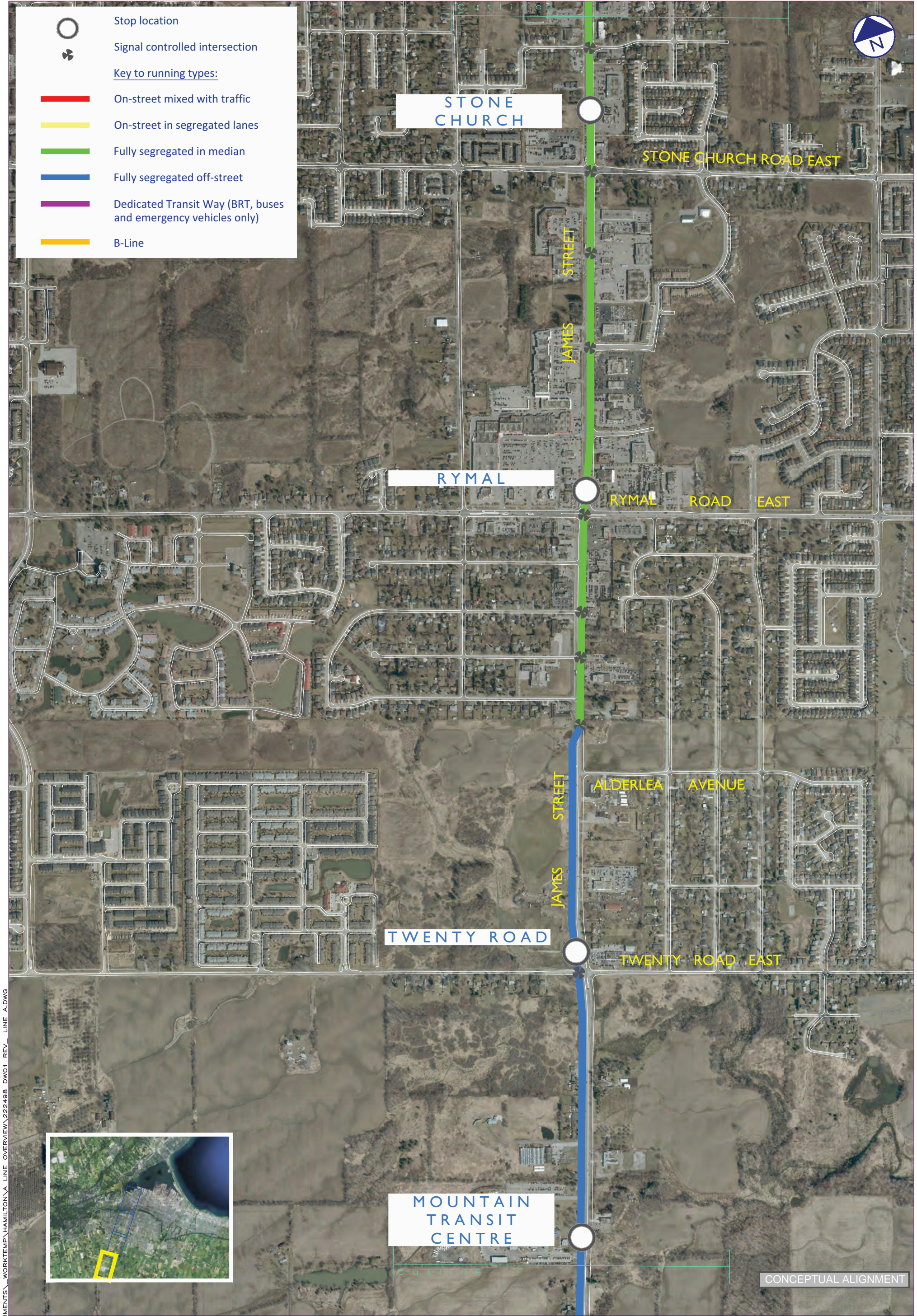
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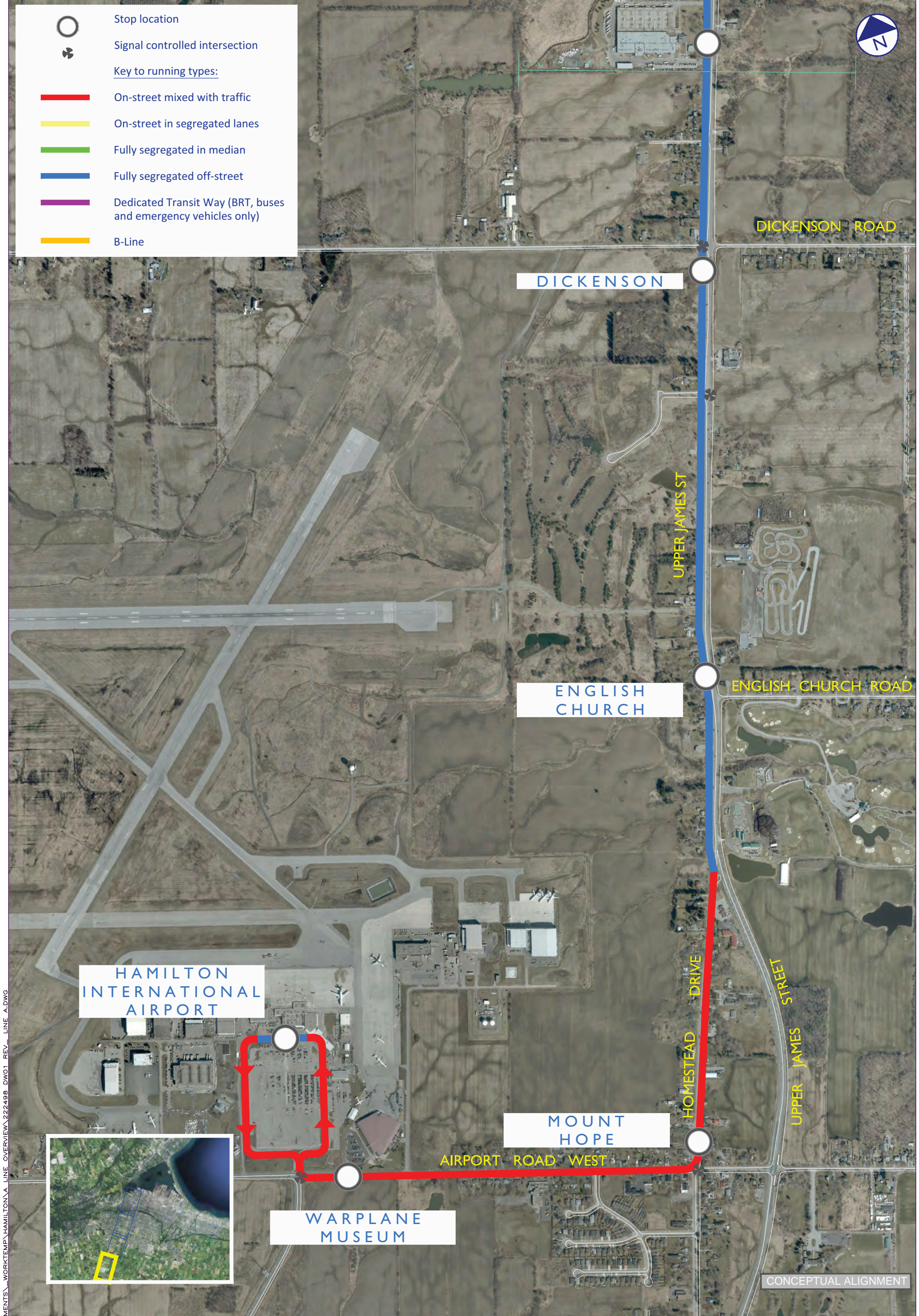
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# **Appendix B**

## **Breeding Birds**



Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
	<b>Ducks, Geese &amp; Swans</b>									
<i>Branta canadensis</i>	Canada Goose	G5	S5			FY	FY	FY	AE	
<i>Cygnus olor</i>	Mute Swan	G5	SNA				FY		FY	
<i>Cygnus buccinator</i>	Trumpeter Swan	G4	S4	NAR	NAR				NE	
<i>Aix sponsa</i>	Wood Duck	G5	S5			FY	P	P	AE	
<i>Anas strepera</i>	Gadwall	G5	S4						FY	
<i>Anas platyrhynchos</i>	Mallard	G5	S5			FY				
<i>Anas crecca</i>	Green-winged Teal	G5	S4						FY	
<i>Aythya americana</i>	Redhead	G5	S2B, S4N						FY	√
<i>Oxyura jamaicensis</i>	Ruddy Duck	G5	S4B, S4N						X	
	<b>Partridges, Grouse &amp; Turkeys</b>									
<i>Phasianus colchicus</i>	Ring-necked Pheasant	G5	SNA			FY	T	T		√* (I)
<i>Bonasa umbellus</i>	Ruffed Grouse	G5	S5				NE			√*
<i>Meleagris gallopavo</i>	Wild Turkey	G5	S5			FY		FY		√* (RI)
	<b>GREBES</b>									
<i>Podiceps grisegena</i>	Red-necked Grebe	G5	S3B, S4N	NAR	NAR				NE	
	<b>CORMORANTS</b>									
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	G5	S5B	NAR	NAR				NY	
	<b>HERONS &amp; BITTERNS</b>									
<i>Ixobrychus exilis</i>	Least Bittern	G5	S4B	THR	THR				S	√
<i>Ardea herodias</i>	Great Blue Heron	G5	S5			H				√*

Bird Species Known from the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
						17NH87	17NH88	17NH98	17NH99	
<i>Butorides virescens</i>	Green Heron	G5	S4B			FY	T	FY	H	
<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	G5	S3B,S3N						NY	
	<b>VULTURES</b>									
<i>Cathartes aura</i>	Turkey Vulture	G5	S5B			T	FY	FY	P	
	<b>HAWKS, KITES &amp; EAGLES</b>									
<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S1S2N, S4B	NAR	SC				X	
<i>Circus cyaneus</i>	Northern Harrier	G5	S4B	NAR	NAR	A	V			√
<i>Accipiter striatus</i>	Sharp-shinned Hawk	G5	S5	NAR	NAR		CF	FY		√
<i>Accipiter cooperii</i>	Cooper's Hawk	G5	S4	NAR	NAR	H	CF	FY	FY	√
<i>Accipiter gentilis</i>	Northern Goshawk	G5	S4	NAR	NAR			FY		√
	Broad-winged Hawk	G5	S5B				NY			√
<i>Buteo jamaicensis</i>	Red-tailed Hawk	G5	S5	NAR	NAR	NY	FY	FY	A	
	<b>CARACARAS &amp; FALCONS</b>									
<i>Falco sparverius</i>	American Kestrel	G5	S5B			NY		FY	FY	√*
<i>Falco columbarius</i>	Merlin	G5	S5B	NAR	NAR			X		
<i>Falco peregrinus anatum/tundrius</i>	Peregrine Falcon	G4T4	S3B	SC	THR			NY	NY	√
	<b>RAILS, GALLINULES &amp; COOTS</b>									
<i>Rallus limicola</i>	Virginiana Rail	G5	S5B						T	√*
<i>Porzana carolina</i>	Sora	G5	S4B				S		S	
<i>Gallinula chloropus</i>	Common Moorhen	G5	S4B						H	√

Bird Species Known from the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
						17NH87	17NH88	17NH98	17NH99	
	<b>PLOVERS</b>									
<i>Charadrius vociferus</i>	Killdeer	G5	S5B, S5N			FY	A	FY	FY	
	<b>SANDPIPERS &amp; PHALAROPES</b>									
<i>Actitis macularia</i>	Spotted Sandpiper	G5	S5			FY	P	AE	FY	
<i>Bartramia longicauda</i>	Upland Sandpiper	G5	S4B			T	T			
<i>Gallinago delicata</i>	Wilson's Snipe	G5	S5B			AE				√
<i>Scolopax minor</i>	American Woodcock	G5	S4B			A	D	T	FY	
	<b>GULLS, TERNS &amp; SKIMMERS</b>									
<i>Larus delawarensis</i>	Ring-billed Gull	G5	S5B, S4N						NY	
<i>Larus argentatus</i>	Herring Gull	G5	S5B, S5N						NY	√*
<i>Larus marinus</i>	Great Black-backed Gull	G5	S2B						X	√
<i>Hydroprogne caspia</i>	Caspian Tern	G5	S3B	NAR	NAR				NY	√*
<i>Sterna hirundo</i>	Common Tern	G5	S4B	NAR	NAR				NE	√*
	<b>PIGEONS &amp; DOVES</b>									
<i>Columba livia</i>	Rock Pigeon	G5	SNA			FY	AE	NY	NE	
<i>Zenaidura macroura</i>	Mourning Dove	G5	S5			AE	AE	FY	FY	
	<b>CUCKOOS &amp; ANIS</b>									
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	G5	S4B			H	T	S		√
<i>Coccyzus erythrophthalmus</i>	Yellow/Black-billed Cuckoo	G5	S4B/S5B				S		S	
<i>Coccyzus americanus/erythrophthalmus</i>	Black-billed Cuckoo	G5	S5B			H	T	CF	H	√*



Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
	<b>BARN OWLS</b>									
<i>Tyto alba</i>	Barn Owl	G5	S1	END	END		T			EX
	<b>TYPICAL OWLS</b>									
<i>Otus asio</i>	Eastern Screech-Owl	G5	S5	NAR	NAR	FY	S	T	FY	√*
<i>Bubo virginianus</i>	Great Horned Owl	G5	S5			NY	S	T	H	√*
<i>Asio otus</i>	Long-eared Owl	G5	S4					T		√
	<b>GOATSUCKERS</b>									
<i>Chordeiles minor</i>	Common Nighthawk	G5	S4B	THR	SC			FY	X	√
	<b>SWIFTS</b>									
<i>Chaetura pelagica</i>	Chimney Swift	G5	S4B, S4N	THR	THR		V	AE	AE	√*
	<b>HUMMINGBIRDS</b>									
<i>Archilochus colubris</i>	Ruby-throated Hummingbird	G5	S5B			T	FY	H	T	√*
	<b>KINGFISHERS</b>									
<i>Ceryle alcyon</i>	Belted Kingfisher	G5	S4B			H	FY	T	AE	√*
	<b>WOODPECKERS</b>									
<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	G5	S4B	THR	SC				H	√
<i>Melanerpes carolinus</i>	Red-bellied Woodpecker	G5	S4			FY	T	H	T	√*
<i>Picoides pubescens</i>	Downy Woodpecker	G5	S5			FY	NY	FY	NY	

Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Picoides villosus</i>	Hairy Woodpecker	G5	S5			A	NY	A	NY	√*
<i>Colaptes auratus</i>	Northern Flicker	G5	S4B			NY	FY	FY	NY	
<i>Dryocopus pileatus</i>	Pileated Woodpecker	G5	S5				N		T	√*
	<b>TYRANT FLYCATCHERS</b>									
<i>Contopus virens</i>	Eastern Wood-Pewee	G5	S4B			FY	A	T	T	
<i>Empidonax alnorum</i>	Alder Flycatcher	G5	S5B			CF	T		S	√*
<i>Empidonax traillii</i>	Willow Flycatcher	G5	S5B			CF	NY	T	T	
<i>Empidonax minimus</i>	Least Flycatcher	G5	S4B			H	T	T		√*
<i>Sayornis phoebe</i>	Eastern Phoebe	G5	S5B			AE	NY	CF	T	√*
<i>Myiarchus crinitus</i>	Great Crested Flycatcher	G5	S4B			CF	T	T	NY	
<i>Tyrannus tyrannus</i>	Eastern Kingbird	G5	S4B			CF	FY	CF	NY	
	<b>VIREOS</b>									
<i>Vireo flavifrons</i>	Yellow-throated Vireo	G5	S4B				S		S	√*
<i>Vireo gilvis</i>	Warbling Vireo	G5	S5B			FY	T	T	FY	
<i>Vireo olivaceus</i>	Red-eyed Vireo	G5	S5B			CF	CF	T	NE	
	<b>CROWS &amp; JAYS</b>									
<i>Cyanocitta cristata</i>	Blue Jay	G5	S5			FY	AE	FY	FY	
<i>Corvus brachyrhynchos</i>	American Crow	G5	S5B			FY	FY	FY	FY	
	<b>LARKS</b>									
<i>Eremophila alpestris</i>	Horned Lark	G5	S5B			CF	P	P	CF	
	<b>SWALLOWS</b>									
<i>Progne subis</i>	Purple Martin	G5	S4B					P	H	√*

Bird Species Known from the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
						17NH87	17NH88	17NH98	17NH99	
<i>Tachycineta bicolor</i>	Tree Swallow	S5	S4B			FY	AE	FY	FY	√*
<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	G5	S4B			FS	FY	AE	FY	
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow	G5	S4B			FY				
<i>Hirundo rustica</i>	Barn Swallow	G5	S4B			FY	AE	FY	NY	
	<b>CHICKADEES &amp; TITMICE</b>									
<i>Poecile atricapillus</i>	Black-capped Chickadee	G5	S5			FY	AE	FY	CF	
<i>Baeolophus bicolor</i>	Tufted Titmouse	G5	S4				FY	S		√*
	<b>NUTHATCHES</b>									
<i>Sitta canadensis</i>	Red-breasted Nuthatch	G5	S5				CF	P		√*
<i>Sitta carolinensis</i>	White-breasted Nuthatch	G5	S5			AE	CF	AE	T	
	<b>CREEPERS</b>									
<i>Certhia americana</i>	Brown Creeper	G5	S5B				FY		S	√*
	<b>WRENS</b>									
<i>Thryothorus ludovicianus</i>	Carolina Wren	G5	S4			AE	FY	T	A	√*
<i>Troglodytes aedon</i>	House Wren	G5	S5B			CF	NY	FY	FY	
<i>Troglodytes troglodytes</i>	Winter Wren	G5	S5B				T		S	√*
<i>Cistothorus platensis</i>	Sedge Wren	G5	S4B	NAR	NAR		T	A		√*
<i>Cistothorus palustris</i>	Marsh Wren	G5	S4B				N		T	√*
	<b>GNATCATCHERS</b>									
<i>Poliophtila caerulea</i>	Blue-gray Gnatcatcher	G5	S4B			H	CF	H	S	√*



Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
	<b>THRUSHES</b>									
<i>Sialia sialis</i>	Eastern Bluebird	G5	S5B	NAR	NAR	FY	AE			√*
<i>Catharus fuscescens</i>	Veery	G5	S4B				CF	T		
<i>Hylocichla mustelina</i>	Wood Thrush	G5	S4B			FY	AE	CF	T	
<i>Turdus migratorius</i>	American Robin	G5	S5B			FY	CF	FY	CF	
	<b>MOCKINGBIRDS &amp; THRASHERS</b>									
<i>Dumetella carolinensis</i>	Gray Catbird	G5	S4B			FY	NE	CF	CF	
<i>Mimus polyglottos</i>	Northern Mockingbird	G5	S4			CF	NE	CF	NY	√*
<i>Toxostoma rufum</i>	Brown Thrasher	G5	S4B			AE	NB	T	T	√*
	<b>STARLINGS</b>									
<i>Sturnus vulgaris</i>	European Starling	G5	SNA			FY	NY	CF	NY	
	<b>WAXWINGS</b>									
<i>Bombycilla cedrorum</i>	Cedar Waxwing	G5	S5B			AE	CF	NY	FY	
	<b>WOOD-WARBLERS</b>									
<i>Vermivora pinus</i>	Blue-winged Warbler	G5	S4B				CF	S	S	√*
<i>Vermivora chrysoptera</i>	Golden-winged Warbler	G4	S4B	THR	SC		T		S	√*
<i>Vermivora pinus/chrysoptera</i>	Blue/Golden-winged Warbler	G5/G4	S4B						S	
<i>Vermivora chrysoptera x pinus</i>	Lawrence's Warbler						A			
<i>Vermivora chrysoptera x pinus</i>	Brewster's Warbler						A		S	
<i>Dendroica petechia</i>	Yellow Warbler	G5	S5B			FY	NE	FY	NE	

Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Dendroica pensylvanica</i>	Chestnut-sided Warbler	G5	S5B				CF	H	S	√*
<i>Dendroica magnolia</i>	Magnolia Warbler	G5	S5B				S		S	√*
<i>Dendroica caerulescens</i>	Black-throated Blue Warbler	G5	S5B				S			√*
<i>Dendroica pinus</i>	Pine Warbler	G5	S5B			S	T		T	√*
<i>Dendroica castanea</i>	Bay-breasted Warbler	G5	S5B					X		
<i>Mniotilta varia</i>	Black-and-white Warbler	G5	S5B				S			√*
<i>Setophaga ruticilla</i>	American Redstart	G5	S5B				CF	S	S	√*
<i>Seiurus aurocapillus</i>	Ovenbird	G5	S4B				A	S	T	
<i>Seiurus motacilla</i>	Louisiana Waterthrush	G5	S3B	SC	SC		A		S	√*
<i>Oporornis philadelphia</i>	Mourning Warbler	G5	S4B				T		S	√*
<i>Geothlypis trichas</i>	Common Yellowthroat	G5	S5B			CF	CF	FY	A	
<i>Wilsonia citrina</i>	Hooded Warbler	G5	S3B	THR	SC		A			√*
<i>Icteria virens</i>	Yellow-breasted Chat	G5	S2B	SC (ssp. <i>virens</i> )	SC		S			√*
	<b>TANAGERS</b>									
<i>Piranga olivacea</i>	Scarlet Tanager	G5	S4B			H	D	P	T	√*
	<b>SPARROWS</b>									
<i>Pipilo erythrophthalmus</i>	Eastern Towhee	G5	S4B			AE	T	P	T	√*
<i>Spizella passerina</i>	Chipping Sparrow	G5	S5B			NY	AE	AE	CF	
<i>Spizella pallida</i>	Clay-colored Sparrow	G5	S4B				T		S	√*
<i>Spizella pusilla</i>	Field Sparrow	G5	S4B			FY	A	CF	NE	
<i>Poecetes gramineus</i>	Vesper Sparrow	G5	S4B			CF	D	S	S	√*
<i>Passerculus SNAdwichensis</i>	Savannah Sparrow	G5	S4B			CF	CF	CF	T	
<i>Ammodramus savannarum</i>	Grasshopper Sparrow	G5	S4B			T	T			√*



Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Melospiza melodia</i>	Song Sparrow	G5	S5B			FY	NE	CF	NY	
<i>Melospiza georgiana</i>	Swamp Sparrow	G5	S5B			T	CF	CF	A	
<i>Zonotrichia albicollis</i>	White-throated Sparrow	G5	S5B				H			√*
	<b>CARDINALS &amp; ALLIES</b>									
<i>Cardinalis cardinalis</i>	Northern Cardinal	G5	S5			FY	CF	CF	FY	
<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak	G5	S4B			FY	AE	A	CF	
<i>Passerina cyanea</i>	Indigo Bunting	G5	S4B			AE	CF	FY	A	
	<b>BLACKBIRDS</b>									
<i>Dolichonyx oryzivorus</i>	Bobolink	G5	S4B	THR		CF	D	A	S	
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	G5	S5			NY	NY	NE	NE	
<i>Sturnella magna</i>	Eastern Meadowlark	G5	S4B			CF	T	A	FY	
<i>Quiscalus quiscula</i>	Common Grackle	G5	S5B			NY	CF	FY	FY	
<i>Molothrus ater</i>	Brown-headed Cowbird	G5	S4B			FY	FY	FY	FY	
<i>Icterus spurius</i>	Orchard Oriole	G5	S4B				NB	D	CF	√*
<i>Icterus galbula</i>	Baltimore Oriole	G5	S4B			FY	NY	NY	FY	
	<b>FINCHES</b>									
<i>Carpodacus mexicanus</i>	House Finch	G5	SNA			FY	FY	CF	FY	
<i>Carduelis tristis</i>	American Goldfinch	G5	S5B			FY	NE	FY	NB	
	<b>OLD WORLD SPARROWS</b>									
<i>Passer domesticus</i>	House Sparrow	G5	SNA			FY	CF	NE	FY	
<i>Dendrocygna autumnalis</i>	Black-bellied Whistling-duck	G5	SNA							

Bird Species Known from the Study Area

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SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Dendrocygna bicolor</i>	Fulvous Whistling-Duck	G5	SNA							
<i>Anser albifrons</i>	Greater White-fronted Goose	G5	SNA							
<i>Chen caerulescens</i>	Snow Goose	G5	S5B							
<i>Chen rossii</i>	Ross's Goose	G4	S1B							
<i>Branta bernicla</i>	Brant	G5	SNA							
<i>Branta hutchinsii</i>	Cackling Goose	G5	S4N							
<i>Cygnus columbianus</i>	Tundra Swan	G5	S4							
<i>Anas penelope</i>	Eurasian Wigeon	G5	SNA							
<i>Anas americana</i>	American Wigeon	G5	S4							
<i>Anas rubripes</i>	American Black Duck	G5	S4							
<i>Anas fulvigula</i>	Mottled Duck	G4								
<i>Anas discors</i>	Blue-winged Teal	G5	S4							
<i>Anas cyanoptera</i>	Cinnamon Teal	G5	SNA							
<i>Anas clypeata</i>	Northern Shoveler	G5	S4							√*
<i>Anas acuta</i>	Northern Pintail	G5	S5							
<i>Anas querquedula</i>	Garganey	G5	SNA							
<i>Aythya valisneria</i>	Canvasback	G5	S1B,S4N							
<i>Aythya collaris</i>	Ring-necked Duck	G5	S5							
<i>Aythya fuligula</i>	Tufted Duck	G5	SNA							
<i>Aythya marila</i>	Greater Scaup	G5	S4							√
<i>Aythya affinis</i>	Lesser Scaup	G5	S4							
<i>Somateria spectabilis</i>	King Eider	G5	SHB							
<i>Somateria mollissima</i>	Common Eider	G5	S2B							√*
<i>Histrionicus histrionicus</i>	Harlequin Duck	G4	SNA							EX
<i>Melanitta perspicillata</i>	Surf Scoter	G5	S4B,S4N							



Bird Species Known from the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
						17NH87	17NH88	17NH98	17NH99	
<i>Melanitta fusca</i>	White-winged Scoter	G5	S4B,S4N							√*
<i>Melanitta nigra</i>	Black Scoter	G5	S4B,S4N							
<i>Clangula hyemalis</i>	Long-tailed Duck	G5	S3B							
<i>Bucephala albeola</i>	Bufflehead	G5	S4							
<i>Bucephala clangula</i>	Common Goldeneye	G5	S5							
<i>Bucephala islandica</i>	Barrow's Goldeneye	G5	SNA	SC						
<i>Mergellus albellus</i>	Smew	G4	SNA							
<i>Lophodytes cucullatus</i>	Hooded Merganser	G5	S5B, S5N							
<i>Mergus merganser</i>	Common Merganser	G5	S5B, S5N							
<i>Mergus serrator</i>	Red-breasted Merganser	G5	S5B, S5N							
<i>Perdix perdix</i>	Gray Partridge	G5	SNA							
<i>Falcapennis canadensis</i>	Spruce Grouse	G5	S5							
<i>Lagopus lagopus</i>	Willow Ptarmigan	G5	S4							
<i>Lagopus mutus</i>	Rock Ptarmigan	G5	SNA							
<i>Tympanuchus phasianellus</i>	Sharp-tailed Grouse	G4	S4							
	<b>New World Quail</b>									
<i>Colinus virginianus</i>	Northern Bobwhite	G5	S1	END	END					
	<b>LOONS</b>									
<i>Gavia stellata</i>	Red-throated Loon	G5	S1N, S3B							
<i>Gavia pacifica</i>	Pacific Loon	G5	S3B							
<i>Gavia immer</i>	Common Loon	G5	S5B, S5N	NAR	NAR					
<i>Gavia adamsii</i>	Yellow-billed loon	G4	SNA	NAR						
<i>Podilymbus podiceps</i>	Pied-billed Grebe	G5	S4B, S4N							

Bird Species Known from the Study Area

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SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Podiceps auritus</i>	Horned Grebe	G5	S1B, S4N	SC	SC					
<i>Podiceps nigricollis</i>	Eared Grebe	G5	SNA							
<i>Aechmophorus occidentalis</i>	Western Grebe	G5	SNA							
	<b>SHEARWATERS &amp; PETRELS</b>									
<i>Fulmarus glacialis</i>	Northern Fulmar	G5	SNA							
<i>Pterodroma hasitata</i>	Black-capped Petrel	G1	SNA							
<i>Puffinus gravis</i>	Greater Shearwater	G5	SNA							√
<i>Puffinus puffinus</i>	Manx Shearwater	G5	SNA							
<i>Puffinus lherminieri</i>	Audubon's Shearwater	G4G5	SNA							√*
	<b>STORM-PETRELS</b>									
<i>Oceanites oceanicus</i>	Wilson's Storm-Petrel	G5	SNA							
<i>Oceanodroma leucorhoa</i>	Leach's Storm-Petrel	G5	SNA							EX
<i>Oceanodroma castro</i>	Band-rumped Storm-Petrel	G4	SNA							
	<b>GANNETS</b>									√*
<i>Morus bassanus</i>	Northern Gannet	G5	SNA							√*
	<b>PELICANS</b>									
<i>Pelecanus erythrorhynchos</i>	American White Pelican	G3	S2B	NAR	THR					
<i>Pelecanus occidentalis</i>	Brown Pelican	G4	SNA							EX
<i>Phalacrocorax brasilianus</i>	Neotropic Cormorant	G5								
<i>Phalacrocorax carbo</i>	Great Cormorant	G5	SNA							√
										√



Bird Species Known from the Study Area

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SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
	<b>ANHINGAS</b>									
<i>Anhinga anhinga</i>	Anhinga	G5	SNA							√
	<b>FRIGATEBIRDS</b>									
<i>Fregata magnificens</i>	Magnificent Frigatebird	G5	SNA							
<i>Botaurus lentiginosus</i>	American Bittern	G4	S4B							√
<i>Ardea alba</i>	Great Egret	G5	S2B							
<i>Egretta thula</i>	Snowy Egret	G5	SNA							
<i>Egretta caerulea</i>	Little Blue Heron	G5	SNA							√
<i>Egretta tricolor</i>	Tricolored Heron	G5	SNA							
<i>Bubulcus ibis</i>	Cattle Egret	G5	SNA							
<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron	G5	SNA							
	<b>IBISES</b>									√*
<i>Eudocimus albus</i>	White Ibis	G5	SNA							
<i>Plegadis falcinellus</i>	Glossy Ibis	G5	SNA							
<i>Plegadis chihi</i>	White-faced Ibis	G5	SNA							
	<b>STORKS</b>									√*
<i>Mycteria americana</i>	Wood Stork	G4	SNA							
<i>Coragyps atratus</i>	Black Vulture	G5	SNA							
<i>Pandion haliaetus</i>	Osprey	G5	S5B							
<i>Elanoides forficatus</i>	Swallow-tailed Kite	G5	SNA							
<i>Ictinia mississippiensis</i>	Mississippi Kite	G5	SNA							√*
<i>Buteo lineatus</i>	Red-shouldered Hawk	G5	S4B	NAR	NAR					

Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Buteo swainsoni</i>	Swainson's Hawk	G5	SNA							
<i>Buteo regalis</i>	Ferruginous Hawk	G4	SNA							
<i>Buteo lagopus</i>	Rough-legged Hawk	G5	S1B, S4N	NAR	NAR					√
<i>Aquila chrysaetos</i>	Golden Eagle	G5	S2B	NAR	END					√*
<i>Caracara cheriway</i>	Crested Caracara	G5	SNA							√
<i>Falco rusticolus</i>	Gyr Falcon	G5	SNA	NAR	NAR					
<i>Falco mexicanus</i>	Prairie Falcon	G5	SNA							√*
<i>Coturnicops noveboracensis</i>	Yellow Rail	G4	S4B	SC	SC					
<i>Laterallus jamaicensis</i>	Black Rail	G4	SNA							
<i>Rallus elegans</i>	King Rail	G4	S2B	END	END					
<i>Porphyryla martinica</i>	Purple Gallinule	G5	SNA							√*
<i>Fulica americana</i>	American Coot	G5	S4B	NAR	NAR					
	<b>CRANES</b>									
<i>Grus canadensis</i>	Sandhill Crane	G5	S5B							
<i>Grus canadensis tabida</i>	Greater Sandhill Crane	G5T4	S4	NAR	NAR					
<i>Grus americana</i>	Whooping Crane	G1	SNA							
<i>Pluvialis squatarola</i>	Black-bellied Plover	G5	S4N							√
<i>Pluvialis dominica</i>	American Golden-Plover	G5	S2S3B, S4N							√*
<i>Charadrius mongolus</i>	Lesser Sand-Plover	G4G5	SNA							
<i>Charadrius alexandrinus</i>	Snowy Plover	G4	SNA							√*
<i>Charadrius wilsonia</i>	Wilson's Plover	G5	SNA							
<i>Charadrius semipalmatus</i>	Semipalmated Plover	G5	S4BS4N							
<i>Charadrius melodus</i>	Piping Plover	G3	S1B	END (ssp. circumcinctus)	END					√*



Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
	<b>OYSTERCATCHERS</b>									
<i>Haematopus palliatus</i>	American Oystercatcher	G5	SNA							
	<b>STILTS &amp; AVOCETS</b>									
<i>Himantopus incanus</i>	Black-necked Stilt	G5	SNA							
<i>Recurvirostra americana</i>	American Avocet	G5	SNA							
<i>Tringa solitaria</i>	Solitary Sandpiper	G5	S4B							
<i>Heteroscelus incanus</i>	Wandering Tattler	G5	SNA							
<i>Tringa erythropus</i>	Spotted Redshank	G5	SNA							
<i>Tringa melanoleuca</i>	Greater Yellowlegs	G5	S4B, S4N							
<i>Catoptrophorus semipalmatus</i>	Willet	G5	SNA							
<i>Tringa flavipes</i>	Lesser Yellowlegs	G5	S4B, S4N							
<i>Numenius borealis</i>	Eskimo Curlew	GH	SHN	END	END					
<i>Numenius phaeopus</i>	Whimbrel	G5	S3S4B, S4N							
<i>Numenius tenuirostris</i>	Slender-billed Curlew	G2G3?	SNA							EX
<i>Numenius americanus</i>	Long-billed Curlew	G5	SNA							
<i>Limosa limosa</i>	Black-tailed Godwit	G5	SNA							
<i>Limosa haemastica</i>	Hudsonian Godwit	G4	S3S4B, S4N							
<i>Limosa fedoa</i>	Marbled Godwit	G5	S3B							
<i>Arenaria interpres</i>	Ruddy Turnstone	G5	SNA							
<i>Calidris canutus</i>	Red Knot	G4	S1N							
<i>Calidris canutus rufa</i>	Red Knot ( <i>rufa</i> subspecies)			END	END					√*
<i>Calidris alba</i>	Sanderling	G5	S5N							

Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Calidris pusilla</i>	Semipalmated Sandpiper	G5	S3B, S4N							√
<i>Calidris mauri</i>	Western Sandpiper	G5	SNA							
<i>Calidris minuta</i>	Little Stint	G5	SNA							
<i>Calidris minutilla</i>	Least Sandpiper	G5	S4B, S5N							
<i>Calidris fuscicollis</i>	White-rumped Sandpiper	G5	S5N							
<i>Calidris bairdii</i>	Baird's Sandpiper	G5	SNA							
<i>Calidris melanotos</i>	Pectoral Sandpiper	G5	SHB, S5N							
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	G5	SNA							
<i>Calidris maritima</i>	Purple Sandpiper	G5	SNA							
<i>Calidris alpina</i>	Dunlin	G5	S4B, S5N							
<i>Calidris ferruginea</i>	Curlew Sandpiper	G5?	SNA							
<i>Calidris himantopus</i>	Stilt Sandpiper	G5	S4B, S4N							
<i>Tryngites subruficollis</i>	Buff-breasted Sandpiper	G4	SNA							
<i>Philomachus pugnax</i>	Ruff	G5	SNA							
<i>Limnodromus griseus</i>	Short-billed Dowitcher	G5	S3S4B, S4N							
<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher	G5	SNA							
<i>Phalaropus tricolor</i>	Wilson's Phalarope	G5	S3B							
<i>Phalaropus lobatus</i>	Red-necked Phalarope	G4G5	S3S4B							
<i>Phalaropus fulicaria</i>	Red Phalarope	G5	SNA							
<i>Rissa tridactyla</i>	Black-legged Kittiwake	G5	SNA							√*
<i>Pagophila eburnea</i>	Ivory Gull	G5	SNA	END						
<i>Xema sabini</i>	Sabine's Gull	G5	SNA							
<i>Larus philadelphia</i> / <i>Chroicocephalus philadelphia</i>	Bonaparte's Gull	G5	S4B, S4N							
<i>Larus ridibundus</i> / <i>Chroicocephalus</i>	Black-headed Gull	G5	SNA							√*



Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>ridibundus</i>										
<i>Larus minutus</i> / <i>Hydrocoloeus minutus</i>	Little Gull	G5	S1B							√*
<i>Rhodostethia rosea</i>	Ross's Gull	G3G4	SNA	THR						
<i>Larus atricilla</i> / <i>Leucophaeus atricilla</i>	Laughing Gull	G5	SNA							
<i>Larus pipixcan</i> / <i>Leucophaeus pipixcan</i>	Franklin's Gull	G4G5	SNA							
<i>Larus heermanni</i>	Heermann's Gull	G4	SNA							
<i>Larus canus</i>	Mew Gull	G5	SNA							
<i>Larus californicus</i>	California Gull	G5	SNA							
<i>Larus thayeri</i>	Thayer's Gull	G5	SNA							
<i>Larus glaucooides</i>	Iceland Gull	G5	S4N							√
<i>Larus fuscus</i>	Lesser Black-backed Gull	G5	SNA							
<i>Larus schistisagus</i>	Slaty-backed Gull	G5	SNA							
<i>Larus hyperboreus</i>	Glaucous Gull	G5	S4N							√*
<i>Sterna fuscata</i>	Sooty Tern	G5	SNA							
<i>Sterna antillarum</i>	Least Tern	G4	SNA							
<i>Chlidonias niger</i>	Black Tern	G4	S3B	NAR	SC					
<i>Chlidonias leucopterus</i>	White-winged Tern	G5	SNA							√*
<i>Sterna paradisaea</i>	Arctic Tern	G5	S4B							
<i>Sterna forsteri</i>	Forster's Tern	G5	S2B	DD	DD					
<i>Sterna maxima</i>	Royal Tern	G5	SNA							
<i>Sterna sandvicensis</i>	Sandwich Tern	G5	SNA							√
<i>Rynchops niger</i>	Black Skimmer	G5	SNA							
	<b>SKUAS &amp; JAEGERES</b>									√*
<i>Catharacta skua</i>	Great Skua	G4G5	SNA							√*

Bird Species Known from the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
						17NH87	17NH88	17NH98	17NH99	
<i>Stercorarius pomarinus</i>	Pomarine Jaeger	G5	SNA							√
<i>Stercorarius parasiticus</i>	Parasitic Jaeger	G5	S2B							
<i>Stercorarius longicaudus</i>	Long-tailed Jaeger	G5	SNA							
										√
	<b>AUKS, MURRES &amp; PUFFINS</b>									
<i>Alle alle</i>	Dovekie	G5	SNA							
<i>Uria lomvia</i>	Thick-billed Murre	G5	SNA							
<i>Alca torda</i>	Razorbill	G5	SNA							√*
<i>Cepphus grylle</i>	Black Guillemot	G5	SHB							
<i>Brachyramphus perdix</i>	Long-billed Murrelet	G4	SNA							
<i>Synthliboramphus antiquus</i>	Ancient Murrelet	G4	SNA							
<i>Fratercula arctica</i>	Atlantic Puffin	G5	SNA							
<i>Patagioenas fasciata</i>	Band-tailed Pigeon	G4	SNA							√*
<i>Streptopelia decaocto</i>	Eurasian Collared-dove	G5	SNA							
<i>Zenaida asiatica</i>	White-winged Dove	G5	SNA							
<i>Columbina inca</i>	Inca Dove	G5	SNA							
<i>Columbina passerina</i>	Common Ground-dove	G5	SNA							
<i>Crotophaga sulcirostris</i>	Groove-billed Ani	G5	SNA							
<i>Nyctea scandiaca</i>	Snowy Owl	G5	SNA	NAR	NAR					
<i>Surnia ulula</i>	Northern Hawk Owl	G5	S4	NAR	NAR					
<i>Athene cunicularia</i>	Burrowing Owl	G4	SNA	END						
<i>Strix varia</i>	Barred Owl	G5	S5							
<i>Strix nebulosa</i>	Great Gray Owl	G5	S4	NAR	NAR					
<i>Asio flammeus</i>	Short-eared Owl	G5	S2N, S4B	SC	SC					
<i>Aegolius funereus</i>	Boreal Owl	G5	S4	NAR	NAR					



Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Aegolius acadicus</i>	Northern Saw-whet Owl	G5	S4							
<i>Chordeiles acutipennis</i>	Lesser Nighthawk	G5	SNA							
<i>Phalaenoptilus nuttallii</i>	Common Poorwill	G5	SNA							
<i>Caprimulgus carolinensis</i>	Chuck-will's-widow	G5	SNA							√*
<i>Caprimulgus vociferus</i>	Whip-poor-will	G5	S4B	THR	THR					
<i>Cypseloides niger</i>	Black Swift	G4								√*
<i>Streptoprocne zonaris</i>	White-collared Swift									
<i>Colibri thalassinus</i>	Green Violet-ear	G5	SNA							
<i>Cynanthus latirostris</i>	Broad-billed Hummingbird	G4	SNA							
<i>Archilochus alexandri</i>	Black-chinned Hummingbird	G5	SNA							
<i>Selasphorus rufus</i>	Rufous Hummingbird	G5	SNA							
<i>Melanerpes lewis</i>	Lewis's Woodpecker	G4	SNA							
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	G5	S5B							
<i>Picoides tridactylus</i>	American Three-toed Woodpecker	G5	S4							
<i>Picoides arcticus</i>	Black-backed Woodpecker	G5	S4							
<i>Contopus cooperi</i>	Olive-sided Flycatcher	G4	S4B	THR	SC					
<i>Contopus sordidulus</i>	Western Wood-pewee	G5	SNA							
<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher	G5	S5B							
<i>Empidonax virescens</i>	Acadian Flycatcher	G5	S2S3B	END	END					
<i>Empidonax wrightii</i>	Gray Flycatcher	G5	SNA							
<i>Empidonax oberholseri</i>	Dusky Flycatcher	G5	SNA							
<i>Sayornis saya</i>	Say's Phoebe	G5	SNA							
<i>Pyrocephalus rubinus</i>	Vermilion Flycatcher	G5	SNA							√*
<i>Myiarchus cinerascens</i>	Ash-throated Flycatcher	G5	SNA							√
<i>Myiodynastes luteiventris</i>	Sulphur-bellied Flycatcher	G5	SNA							

Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Empidonomus varius</i>	Variegated Flycatcher	G5	SNA							
<i>Tyrannus melancholicus</i>	Tropical Kingbird	G5								
<i>Tyrannus vociferans</i>	Cassin's Kingbird	G5	SNA							
<i>Tyrannus verticalis</i>	Western Kingbird	G5	S1B							
<i>Tyrannus dominicensis</i>	Gray Kingbird	G5	SNA							√*
<i>Tyrannus forficatus</i>	Scissor-tailed Flycatcher	G5	SNA							
<i>Tyrannus savana</i>	Fork-tailed Flycatcher	G5	SNA							
	<b>SHRIKES</b>									√*
<i>Lanius ludovicianus</i>	Loggerhead Shrike	G4	S2B	END (ssp. migrans)	END					√
<i>Lanius excubitor</i>	Northern Shrike	G5	SNA							
<i>Vireo griseus</i>	White-eyed Vireo	G5	S2B							√
<i>Vireo bellii</i>	Bell's Vireo	G5	SNA							√
<i>Vireo atricapillus</i>	Black-capped Vireo	G2G3	SNA							
<i>Vireo plumbeus</i>	Plumbeous Vireo	G5	SNA							√
<i>Vireo solitarius</i>	Blue-headed Vireo	G5	S5B							
<i>Vireo philadelphicus</i>	Philadelphia Vireo	G5	S5B							
<i>Perisoreus canadensis</i>	Gray Jay	G5	S5							√
<i>Nucifraga columbiana</i>	Clark's Nutcracker	G5	SNA							
<i>Pica hudsonia</i>	Black-billed Magpie	G5	S3?							√*
<i>Corvus monedula</i>	Eurasian Jackdaw	G5	SNA							
<i>Corvus ossifragus</i>	Fish Crow	G5	SNA							√
<i>Corvus corax</i>	Common Raven	G5	S5							
<i>Tachycineta thalassina</i>	Violet-green Swallow	G5	SNA							
<i>Riparia riparia</i>	Bank Swallow	G5	S4B							



Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Petrochelidon fulva</i>	Cave Swallow	G5	SNA							
<i>Poecile carolinensis</i>	Carolina Chickadee	G5	SNA							
<i>Poecile hudsonicus</i>	Boreal Chickadee	G5	S5							√
<i>Salpinctes obsoletus</i>	Rock Wren	G5	SNA							√*
<i>Thryomanes bewickii</i>	Bewick's Wren	G5	SHB							√*
										√
	<b>KINGLETS</b>									
<i>Regulus satrapa</i>	Golden-crowned Kinglet	G5	S5B							
<i>Regulus calendula</i>	Ruby-crowned Kinglet	G5	S4B							
<i>Luscinia calliope</i>	Siberian Rubythroat	G5	SNA							
<i>Oenanthe oenanthe</i>	Northern Wheatear	G5	SNA							√
<i>Sialia currucoides</i>	Mountain Bluebird	G5	SNA							√
<i>Myadestes townsendi</i>	Townsend's Solitaire	G5	SNA							
<i>Catharus minimus</i>	Gray-cheeked Thrush	G5	S2S4B							√*
<i>Catharus bicknelli</i>	Bicknell's Thrush	G4	SNA							
<i>Catharus ustulatus</i>	Swainson's Thrush	G5	S4B							
<i>Catharus guttatus</i>	Hermit Thrush	G5	S5B							√
<i>Turdus merula</i>	Eurasian Blackbird	G5	SNA							
<i>Turdus pilaris</i>	Fieldfare	G5	SNA							√*
<i>Ixoreus naevius</i>	Varied Thrush	G5	SNA							
<i>Oreoscoptes montanus</i>	Sage Thrasher	G5	SNA							√
	<b>PIPITS</b>									
<i>Anthus rubescens</i>	American Pipit	G5	S4							
<i>Anthus spragueii</i>	Sprague's Pipit	G4	SNA							√*

Bird Species Known from the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
						17NH87	17NH88	17NH98	17NH99	
<i>Bombycilla garrulus</i>	Bohemian Waxwing	G5	SNA							
	<b>SILKY-FLYCATCHERS</b>									
<i>Phainopepla nitens</i>	Phainopepla	G5	SNA							
<i>Vermivora peregrina</i>	Tennessee Warbler	G5	S5B							
<i>Vermivora celata</i>	Orange-crowned Warbler	G5	S4B							√*
<i>Vermivora ruficapilla</i>	Nashville Warbler	G5	S5B							
<i>Vermivora virginiae</i>	Virginia's Warbler	G5	SNA							
<i>Parula americana</i>	Northern Parula	G5	S4B							
<i>Dendroica tigrina</i>	Cape May Warbler	G5	S5B							
<i>Dendroica coronata</i>	Yellow-rumped Warbler	G5	S5B							√
<i>Dendroica nigrescens</i>	Black-throated Gray Warbler	G5	SNA							
<i>Dendroica virens</i>	Black-throated Green Warbler	G5	S5B							
<i>Dendroica townsendi</i>	Townsend's Warbler	G5	SNA							√*
<i>Dendroica occidentalis</i>	Hermit Warbler	G4G5	SNA							
<i>Dendroica fusca</i>	Blackburnian Warbler	G5	S5B							
<i>Dendroica dominica</i>	Yellow-throated Warbler	G5	SNA							
<i>Dendroica kirtlandii</i>	Kirtland's Warbler	G1	S1B	END	END					
<i>Dendroica discolor</i>	Prairie Warbler	G5	S3B	NAR	NAR					√*
	Palm Warbler	G5	SNRB							
<i>Dendroica palmarum hypochrysea</i>	Yellow Palm Warbler	G5TU	S1B							EX
<i>Dendroica palmarum palmarum</i>	Western Palm Warbler	G5T5	S5B							
<i>Dendroica striata</i>	Blackpoll Warbler	G5	S4B							
<i>Protonotaria citrea</i>	Prothonotary Warbler	G5	S1B	END	END					
<i>Helmitheros vermivorus</i>	Worm-eating Warbler	G5	SNA							



Bird Species Known from the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
						17NH87	17NH88	17NH98	17NH99	
<i>Limnothlypis swainsonii</i>	Swainson's Warbler	G4	SNA							
<i>Seiurus noveboracensis</i>	Northern Waterthrush	G5	S5B							
<i>Oporornis formosus</i>	Kentucky Warbler	G5	SNA							√*
<i>Oporornis agilis</i>	Connecticut Warbler	G4	S4B							
<i>Oporornis tolmiei</i>	Macgillivray's Warbler	G5	SNA							
<i>Wilsonia pusilla</i>	Wilson's Warbler	G5	S4B							
<i>Myioborus pictus</i>	Painted Redstart	G5	SNA							
<i>Piranga rubra</i>	Summer Tanager	G5	SNA							
<i>Piranga ludoviciana</i>	Western Tanager	G5	SNA							
<i>Pipilo chlorurus</i>	Green-tailed Towhee	G5	SNA							
<i>Pipilo maculatus</i>	Spotted Towhee	G5	SNA							
<i>Aimophila cassinii</i>	Cassin's Sparrow	G5	SNA							
<i>Aimophila aestivalis</i>	Bachman's Sparrow	G3	SNA							
<i>Spizella arborea</i>	American Tree Sparrow	G5	S4B							
<i>Spizella breweri</i>	Brewer's Sparrow	G5								
<i>Chondestes grammacus</i>	Lark Sparrow	G5	SHB							
<i>Amphispiza bilineata</i>	Black-throated Sparrow	G5	SNA							
<i>Calamospiza melanocorys</i>	Lark Bunting	G5	SNA							
<i>Ammodramus bairdii</i>	Baird's Sparrow	G4	SNA	NAR						
<i>Ammodramus henslowii</i>	Henslow's Sparrow	G4	SHB	END	END					
<i>Ammodramus leconteii</i>	Le Conte's Sparrow	G4	S4B							
<i>Ammodramus nelsoni</i>	Nelson's Sharp-tailed Sparrow	G5	S4B	NAR	NAR					
<i>Passerella iliaca</i>	Fox Sparrow	G5	S4B							√
<i>Melospiza lincolni</i>	Lincoln's Sparrow	G5	S5B							
<i>Zonotrichia querula</i>	Harris's Sparrow	G5	SNA							

Bird Species Known from the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
						17NH87	17NH88	17NH98	17NH99	
<i>Zonotrichia leucophrys</i>	White-crowned Sparrow	G5	S4B							
<i>Zonotrichia atricapilla</i>	Golden-crowned Sparrow	G5	SNA							
<i>Junco hyemalis</i>	Dark-eyed Junco	G5	S5B							
<i>Calcarius mccownii</i>	McCown's Longspur	G4		SC						√
<i>Calcarius lapponicus</i>	Lapland Longspur	G5	S3B							
<i>Calcarius pictus</i>	Smith's Longspur	G5	S4B							
<i>Calcarius ornatus</i>	Chestnut-collared Longspur	G5	SNA							
<i>Plectrophenax nivalis</i>	Snow Bunting	G5	SNA							
<i>Pheucticus melanocephalus</i>	Black-headed Grosbeak	G5	SNA							
<i>Guiraca caerulea</i>	Blue Grosbeak	G5	SNA							
<i>Passerina amoena</i>	Lazuli Bunting	G5	SNA							√*
<i>Passerina versicolor</i>	Varied Bunting	G5	SNA							
<i>Passerina ciris</i>	Painted Bunting	G5	SNA							
<i>Spiza americana</i>	Dickcissel	G5	SNA							
<i>Sturnella neglecta</i>	Western Meadowlark	G5	S3B							
<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird	G5	S2B							
<i>Euphagus carolinus</i>	Rusty Blackbird	G4	S4B	SC	NAR					
<i>Euphagus cyanocephalus</i>	Brewer's Blackbird	G5	S4B							
<i>Quiscalus mexicanus</i>	Great-tailed Grackle	G5	SNA							
<i>Icterus cucullatus</i>	Hooded Oriole	G5	SNA							
<i>Icterus bullockii</i>	Bullock's Oriole	G5	SNA							√
<i>Icterus parisorum</i>	Scott's Oriole	G5	SNA							
<i>Fringilla montifringilla</i>	Brambling	G5	SNA							
<i>Leucosticte tephrocotis</i>	Gray-crowned Rosy-Finch	G5	SNA							
<i>Pinicola enucleator</i>	Pine Grosbeak	G5	S4B							



Bird Species Known from the Study Area

						OBBA 2nd Atlas Highest Breeding Evidence				Hamilton Significant Breeding Birds
SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	17NH87	17NH88	17NH98	17NH99	
<i>Carpodacus purpureus</i>	Purple Finch	G5	S4B							
<i>Carpodacus cassinii</i>	Cassin's Finch	G5	SNA							
<i>Loxia curvirostra</i>	Red Crossbill	G5	S4B							EX
<i>Loxia leucoptera</i>	White-winged Crossbill	G5	S5B							
<i>Carduelis flammea</i>	Common Redpoll	G5	S4B							
<i>Carduelis hornemanni</i>	Hoary Redpoll	G5	SNA							
<i>Carduelis pinus</i>	Pine Siskin	G5	S4B							
<i>Carduelis psaltria</i>	Lesser Goldfinch	G5	SNA							
<i>Coccothraustes vespertinus</i>	Evening Grosbeak	G5	S4B							
<i>Passer montanus</i>	Eurasian Tree Sparrow	G5	SNA							

# **Appendix C**

## **Herpetofauna Species List**



Appendix C Herpetofaunal Species Known from the Vicinity of the Study Area

Ontario  
Reptile and  
Amphibian  
Atlas

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	
<b>Turtles</b>						
<i>Apalone spinifera spinifera</i>	Eastern Spiny Softshell	G5T5	S3	THR	THR	X
<i>Chelydra serpentina serpentina</i>	Common Snapping Turtle	G5T5	S5	SC	SC	X
<i>Chrysemys picta marginata</i>	Midland Painted Turtle	G5T5	S5			X
<i>Emydoidea blandingii</i>	Blanding's Turtle ( <i>Great Lakes/St Lawrence population</i> )	G4	S3	THR	THR	X
<i>Sternotherus odoratus</i>	Eastern Musk Turtle	G5	S3	T	THR	X
<i>Graptemys geographica</i>	Northern Map Turtle	G5	S3	SC	SC	X
<b>Snakes</b>						
<i>Lampropeltis t. triangulum</i>	Eastern Milksnake	G5T5	S3	SC	SC	X
<i>Nerodia sipedon sipedon</i>	Northern Watersnake	G5T5	S5	NAR	NAR	X
<i>Storeria dekayi dekayi</i>	DeKay's Brownsnake	G5T?	S5	NAR	NAR	X
<i>Thamnophis sirtalis sirtalis</i>	Eastern Gartersnake	G5T?	S5			X
<i>Diadophis punctatus edwardsi</i>	Ring-necked Snake	G5	S4			X
<i>Storeria occipitomaculata occipitomaculata</i>	Red-bellied Snake	G5T5	S5			X
<i>Opheodrys vernalis</i>	Smooth Greensnake	G5	S4			X
<b>Salamanders</b>						
<i>Ambystoma jeffersonianum-laterale polyploids</i>	Jefferson/Blue-spotted Salamander Polyploids	hybrid	S2			X
<i>Ambystoma laterale</i>	Blue-spotted Salamander	G5	S4			X
<i>Ambystoma maculatum</i>	Spotted Salamander	G5	S4			X
<i>Necturus maculosus</i>	Mudpuppy	G5	S4	NAR	NAR	X
<i>Notophthalmus viridescens viridescens</i>	Eastern Newt	G5T5	S5			X
<i>Plethodon cinereus</i>	Eastern Red-backed Salamander	G5	S5			X
<i>Hemidactylium scutatum</i>	Four-toed Salamander	G5	S4	NAR	NAR	X

Appendix C Herpetofaunal Species Known from the Vicinity of the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	SARO	Ontario Reptile and Amphibian Atlas
<b>Toads and Frogs</b>						
<i>Bufo americanus</i>	American Toad	G5	S5			X
<i>Pseudacris triseriata</i> (Great Lakes/St. Lawrence - Canadian Shield pop'n)	Western Chorus Frog	G5	S3	THR	NAR	X
<i>Pseudacris crucifer crucifer</i>	Northern Spring Peeper	G5	S5			X
<i>Rana clamitans melanota</i>	Green Frog	G5	S5			X
<i>Hyla versicolor</i>	Gray Treefrog	G5	S5			X
<i>Rana pipiens</i>	Northern Leopard Frog	G5	S5	NAR	NAR	X
<i>Rana palustris</i>	Pickerel Frog	G5	S4	NAR	NAR	X
<i>Rana catesbeiana</i>	Bullfrog	G5	S4			X
<i>Rana sylvatica</i>	Wood Frog	G5	S5			X



# **Appendix D**

## **Mammals**

Appendix D Mammal Species Known from the Study Area

SCIENTIFIC NAME	COMMON NAME	GRANK	SRANK	COSEWIC	OMNR	Ontario Mammal Atlas	NHIC Biodiversity Explorer
<i>Blarina brevicauda</i>	Northern Short-tailed Shrew	G5	S5			X	
<i>Castor canadensis</i>	Beaver	G5	S5			X	
<i>Didelphis virginiana</i>	Virginia Opossum	G5	S4			X	
<i>Eptesicus fuscus</i>	Big Brown Bat	G5	S5			X	
<i>Lepus europaeus</i>	European Hare	G5	SE			X	
<i>Marmota monax</i>	Woodchuck	G5	S5			X	
<i>Mephitis mephitis</i>	Striped Skunk	G5	S5			X	
<i>Microtus pennsylvanicus</i>	Meadow Vole	G5	S5			X	
<i>Mustela vison</i>	Mink	G5	S5			X	
<i>Myotis lucifuga</i>	Little Brown Bat	G5	S5			X	
<i>Odocoileus virginianus</i>	White-tailed Deer	G5	S5			X	
<i>Ondatra zibethicus</i>	Muskrat	G5	S5			X	
<i>Peromyscus leucopus</i>	White-footed Mouse	G5	S5			X	
<i>Microtus pinetorum</i>	Woodland Vole	G5	S3?	SC	SC		X
<i>Procyon lotor</i>	Raccoon	G5	S5			X	
<i>Sciurus carolinensis</i>	Gray Squirrel Black Morph	G5	S5			X	
<i>Sciurus carolinensis</i>	Gray Squirrel Gray Morph	G5	S5			X	
<i>Sorex cinereus</i>	Masked (Common) Shrew	G5	S5			X	
<i>Sorex fumeus</i>	Smokey Shrew	G5	S5			X	
<i>Sylvilagus floridanus</i>	Eastern Cottontail	G5	S5			X	
<i>Tamias striatus</i>	Eastern Chipmunk	G5	S5			X	
<i>Tamiasciurus hudsonicus</i>	Red Squirrel	G5	S5			X	
<i>Vulpes vulpes</i>	Red Fox	G5	S5			X	
<i>Zapus hudsonius</i>	Meadow Jumping Mouse	G5	S5			X	



# **Appendix E**

## **Vascular Plant Species**

Family	Genus	Species	Scientific Name	Common Names	GlobalRank	SRank	Introduced
ACERACEAE	Acer	negundo	<i>Acer negundo</i>	Manitoba Maple	G5	S5	
	Acer	platanooides	<i>Acer platanooides</i>	Norway Maple	G?	SE5	I
	Acer	saccharum	<i>Acer saccharum ssp. saccharum</i>	Sugar Maple	G5	S5	
	Acer	X freemanii	<i>Acer X freemanii</i>	Freeman's Maple	G?	S5	
ANACARDIACEAE	Rhus	radicans	<i>Rhus radicans ssp. negundo</i>	Climbing Poison-ivy	G5	S5	
	Rhus	typhina	<i>Rhus typhina</i>	Staghorn Sumac	G5	S5	
APIACEAE	Daucus	carota	<i>Daucus carota</i>	Wild Carrot	G?	SE5	I
ASCLEPIADACEAE	Asclepias	syriaca	<i>Asclepias syriaca</i>	Common Milkweed	G5	S5	
ASTERACEAE	Achillea	millefolium	<i>Achillea millefolium ssp. millefolium</i>	Common Yarrow	G5	SE	I
	Ambrosia	artemisiifolia	<i>Ambrosia artemisiifolia</i>	Common Ragweed	G5	S5	
	Antennaria	neglecta	<i>Antennaria neglecta</i>	Field Pussytoes	G5	S5	
	Arctium	minus	<i>Arctium minus ssp. minus</i>	Common Burdock	G?	SE5	I
	Aster	ericoides	<i>Aster ericoides var. ericoides</i>	Heath Aster	G5	S5	
	Aster	lateriflorus	<i>Aster lateriflorus var. hirsuticaulis</i>	Calico Aster	G5	S4?	
	Aster	macrophyllus	<i>Aster macrophyllus</i>	Large-leaved Aster	G5	S5	
	Aster	novae-angliae	<i>Aster novae-angliae</i>	New England Aster	G5	S5	
	Aster	sp	<i>Aster sp</i>	Aster Species			
	Bellis	perennis	<i>Bellis perennis</i>	English Daisy	G?	SE5	I



Family	Genus	Species	Scientific Name	Common Names	GlobalRank	SRank	Introduced
	Bidens	cernua	<i>Bidens cernua</i>	Nodding Beggar-ticks	G5	S5	
	Cichorium	intybus	<i>Cichorium intybus</i>	Chicory	G?	SE5	I
	Cirsium	vulgare	<i>Cirsium vulgare</i>	Bull Thistle	G5	SE5	I
	Crepis	tectorum	<i>Crepis tectorum</i>	Narrow-leaved Hawk's Beard	G?	SE5	I
	Erigeron	annuus	<i>Erigeron annuus</i>	Daisy Fleabane	G5	S5	
	Eupatorium	maculatum	<i>Eupatorium maculatum ssp. maculatum</i>	Spotted Joe-pye-weed	G5	S5	
	Euthamia	graminifolia	<i>Euthamia graminifolia</i>	Grass-leaved Goldenrod	G5	S5	
	Lactuca	serriola	<i>Lactuca serriola</i>	Prickly Lettuce	G?	SE5	I
	Solidago	altissima	<i>Solidago altissima var. altissima</i>	Tall Goldenrod	G?	S5	
	Solidago	rugosa	<i>Solidago rugosa ssp. rugosa</i>	Rough Goldenrod	G5	S5	
	Taraxacum	officinale	<i>Taraxacum officinale</i>	Common Dandelion	G5	SE5	I
	Tussilago	farfara	<i>Tussilago farfara</i>	Coltsfoot	G?	SE5	I
<b>BALSAMINACEAE</b>	Impatiens	capensis	<i>Impatiens capensis</i>	Spotted Touch-me-not	G5	S5	
<b>BETULACEAE</b>	Betula	papyrifera	<i>Betula papyrifera</i>	White Birch	G5	S5	
<b>BRASSICACEAE</b>	Alliaria	petiolata	<i>Alliaria petiolata</i>	Garlic Mustard	G?	SE5	I
	Capsella	bursa-pastoris	<i>Capsella bursa-pastoris</i>	Shepherd's Purse	G?	SE5	I
	Lepidium	densiflorum	<i>Lepidium densiflorum</i>	Common Pepper-grass	G5	SE5	I
<b>CAPRIFOLIACEAE</b>	Lonicera	tatarica	<i>Lonicera tatarica</i>	Tartarian Honeysuckle	G?	SE5	I

Family	Genus	Species	Scientific Name	Common Names	GlobalRank	SRank	Introduced
	Sambucus	racemosa	<i>Sambucus racemosa ssp. pubens</i>	Red-berried Elderberry	G5	S5	
CARYOPHYLLACEAE	Cerastium	fontanum	<i>Cerastium fontanum</i>	Common Mouse-ear Chickweed	G?	SE5	I
	Silene	latifolia	<i>Silene latifolia</i>	Bladder Campion	G?	SE5	I
CHENOPODIACEAE	Chenopodium	album	<i>Chenopodium album var. album</i>	Lamb's Quarters	G5	SE5	I
CLUSIACEAE	Hypericum	perforatum	<i>Hypericum perforatum</i>	Common St. John's-wort	G?	SE5	I
CONVOLVULACEAE	Convolvulus	arvensis	<i>Convolvulus arvensis</i>	Field Bindweed	G?	SE5	I
	Convolvulus	arvensis	<i>Convolvulus arvensis</i>	Field Bindweed	G?	SE5	I
CORNACEAE	Cornus	foemina	<i>Cornus foemina ssp. racemosa</i>	Grey Dogwood	G5	S5	
	Cornus	stolonifera	<i>Cornus stolonifera</i>	Red-osier Dogwood	G5	S5	
CUPRESSACEAE	Thuja	occidentalis	<i>Thuja occidentalis</i>	Eastern White Cedar	G5	S5	
CYPERACEAE	Carex	bebbii	<i>Carex bebbii</i>	Bebb's Sedge	G5	S5	
	Carex	hirta	<i>Carex hirta</i>	Hammer Sedge	G?	SE2	I
DIPSACACEAE	Dipsacus	fullonum	<i>Dipsacus fullonum ssp. sylvestris</i>	Common Teasel	G?	SE5	I
EQUISETACEAE	Equisetum	arvense	<i>Equisetum arvense</i>	Field Horsetail	G5	S5	
FABACEAE	Coronilla	varia	<i>Coronilla varia</i>	Trailing Crown-vetch	G?	SE5	I
	Lotus	corniculatus	<i>Lotus corniculatus</i>	Bird's-foot Trefoil	G?		I
	Medicago	lupulina	<i>Medicago lupulina</i>	Black Medick	G?	SE5	I
	Melilotus	alba	<i>Melilotus alba</i>	White Sweet-clover	G5	SE5	I



Family	Genus	Species	Scientific Name	Common Names	GlobalRank	SRank	Introduced
	Robinia	pseudo-acacia	<i>Robinia pseudo-acacia</i>	Black Locust	G5	SE5	I
	Trifolium	hybridum	<i>Trifolium hybridum ssp. elegans</i>	Alsike Clover	G?	SE5	I
	Trifolium	pratense	<i>Trifolium pratense</i>	Red Clover	G?	SE5	I
	Trifolium	repens	<i>Trifolium repens</i>	White Clover	G?	SE5	I
	Quercus	rubra	<i>Quercus rubra</i>	Red Oak	G5	S5	
GROSSULARIACEAE	Ribes	rubrum	<i>Ribes rubrum</i>	Garden Red Currant	G4G5	SE5	I
JUGLANDACEAE	Juglans	nigra	<i>Juglans nigra</i>	Black Walnut	G5	S4	
OLEACEAE	Fraxinus	americana	<i>Fraxinus americana</i>	White Ash	G5	S5	
PAPAVERACEAE	Chelidonium	majus	<i>Chelidonium majus</i>	Celandine	G?	SE5	I
PINACEAE	Picea	abies	<i>Picea abies</i>	Norway Spruce	G?	SE3	I
	Picea	glauca	<i>Picea glauca</i>	White Spruce	G5	S5	
	Pinus	nigra	<i>Pinus nigra</i>	Austrian Pine	G?	SE2	I
	Pinus	strobus	<i>Pinus strobus</i>	Eastern White Pine	G5	S5	
PLANTAGINACEAE	Plantago	major	<i>Plantago major</i>	Common Plantain	G5	SE5	I
POACEAE	Agrostis	gigantea	<i>Agrostis gigantea</i>	Redtop Grass	G4G5	SE5	I
	Bromus	inermis	<i>Bromus inermis ssp. inermis</i>	Smooth Brome	G4G5	SE5	I
	Echinochloa	crusgalli	<i>Echinochloa crusgalli</i>	Barnyard Grass	G?	SE5	I
	Festuca	rubra	<i>Festuca rubra</i>	Red Fescue	G5	S5	
	Phalaris	arundinacea	<i>Phalaris arundinacea</i>	Reed Canary	G5	S5	

Family	Genus	Species	Scientific Name	Common Names	GlobalRank	SRank	Introduced
				Grass			
	Phleum	pratense	<i>Phleum pratense</i>	Timothy	G?	SE5	I
	Phragmites	australis	<i>Phragmites australis</i>	Common Reed	G5	S5	
	Poa	pratensis	<i>Poa pratensis ssp. pratensis</i>	Kentucky Blue Grass	G?	S5	
	Setaria	viridis	<i>Setaria viridis</i>	Green Foxtail	G?	SE5	I
POLYGONACEAE	Polygonum	persicaria	<i>Polygonum persicaria</i>	Lady's Thumb	G?	SE5	I
RANUNCULACEAE	Ranunculus	acris	<i>Ranunculus acris</i>	Tall Buttercup	G5	SE5	I
RHAMNACEAE	Rhamnus	cathartica	<i>Rhamnus cathartica</i>	Common Buckthorn	G?	SE5	I
ROSACEAE	Crataegus	sp	<i>Crataegus sp</i>	Hawthorn Species			
	Geum	aleppicum	<i>Geum aleppicum</i>	Yellow Avens	G5	S5	
	Geum	laciniatum	<i>Geum laciniatum</i>	Rough Avens	G5	S4	
	Potentilla	norvegica	<i>Potentilla norvegica ssp. monspeliensis</i>	Rough Cinquefoil	G5	S5	
	Prunus	serotina	<i>Prunus serotina</i>	Black Cherry	G5	S5	
	Prunus	virginiana	<i>Prunus virginiana ssp. virginiana</i>	Choke Cherry	G5	S5	
	Rubus	idaeus	<i>Rubus idaeus ssp. idaeus</i>	Red Raspberry	G5	SE1	I
SALICACEAE	Populus	balsamifera	<i>Populus balsamifera ssp. balsamifera</i>	Balsam Poplar	G5	S5	
	Salix	alba	<i>Salix alba</i>	White Willow	G5	SE4	I
	Salix	bebbiana	<i>Salix bebbiana</i>	Bebb's Willow	G5	S5	



Family	Genus	Species	Scientific Name	Common Names	GlobalRank	SRank	Introduced
	Salix	fragilis	<i>Salix fragilis</i>	Crack Willow	G?	SE5	I
	Salix	petiolaris	<i>Salix petiolaris</i>	Slender Willow	G5	S5	
	Salix	sp	<i>Salix sp</i>	Willow Species			
SCROPHULARIACEAE	Verbascum	thapsus	<i>Verbascum thapsus</i>	Common Mullein	G?	SE5	I
SOLANACEAE	Solanum	dulcamara	<i>Solanum dulcamara</i>	Bittersweet Nightshade	G?	SE5	I
TYPHACEAE	Typha	latifolia	<i>Typha latifolia</i>	Broad-leaved Cattail	G5	S5	
ULMACEAE	Ulmus	americana	<i>Ulmus americana</i>	White Elm	G5?	S5	
VITACEAE	Parthenocissus	quinquefolia	<i>Parthenocissus quinquefolia</i>	Virginia Creeper	G5	S4?	
	Vitis	riparia	<i>Vitis riparia</i>	Riverbank Grape	G5	S5	